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A compilation of the summary portions of the Research and Technology Objectives and Plans *(RTOPS)* used for management and control of research currently in progress throughout NASA has been published under the title *Research and Technology Objectives and Plans Summary, Fiscal Year 1978*. It is announced as accession number N78-11861 on page 259 of this issue of *STAR*.

This *RTOP SUMMARY* also should help expedite the NASA program of technology transfer to the private sector.

RTOP SUMMARY FY1978 may be purchased from the National Technical Information Service, Springfield, Virginia, 22161, for $4.75 in paper copy or $3.00 in microfiche. (The cost for customers outside the United States is $9.50). The accession number N78-11861 should be specified when ordering this publication.

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Subject scope of *STAR*, *IAA*, and *On-Going Research Projects* includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

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Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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82 DOCUMENTATION AND INFORMATION SCIENCE 260
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 263
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) 264

89 ASTRONOMY 272
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 273
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 274
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 274
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 275
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 277

Note: N.A. means that no abstracts were assigned to this category for this issue.

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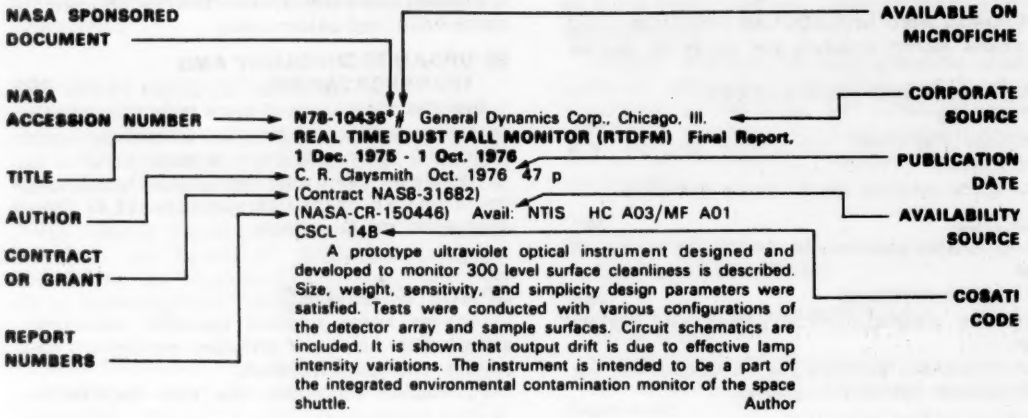
TYPICAL CITATION AND ABSTRACT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NASA ACCESSION NUMBER
N78-10436*# General Dynamics Corp., Chicago, Ill.
CORPORATE SOURCE
REAL TIME DUST FALL MONITOR (RTDFM) Final Report, 1 Dec. 1975 - 1 Oct. 1976
TITLE
C. R. Claysmith Oct. 1976 47 p
PUBLICATION DATE
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(Contract NAS8-31682)
(NASA-CR-150446) Avail: NTIS HC A03/MF A01
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COSATI CODE
A prototype ultraviolet optical instrument designed and developed to monitor 300 level surface cleanliness is described. Size, weight, sensitivity, and simplicity design parameters were satisfied. Tests were conducted with various configurations of the detector array and sample surfaces. Circuit schematics are included. It is shown that output drift is due to effective lamp intensity variations. The instrument is intended to be a part of the integrated environmental contamination monitor of the space shuttle.
Author
REPORT NUMBERS

ON-GOING RESEARCH PROJECTS

This is a listing of research projects – not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, A STUDY OF STALL AVOIDANCE TO DETERMINE STALL PREDICTION CRITERIA
T. LEONARD, Calif. State Univ. & Colleges, School of Applied Sci. & Arts, *San Jose, California* 95114 (NCA 2-675709)

The value of computer programs currently being used in airfoil design and airfoil optimization can be enhanced by the incorporation of separation estimation and modelings. Separation prediction criteria can be developed by the modification of presently used two-dimensional boundary layer programs, and the comparison of these theoretical results with wind tunnel and flight results.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0002, HIGH ANGLE OF ATTACK AERODYNAMICS OF FIGHTER CONFIGURATIONS
J. HEADLEY, Northrop Corporation, *Hawthorne, California* 90250 (DF139900; F33615-77-C-3062)

Combat maneuver performance improvements continue to be a major design goal for fighter aircraft. The maneuver capability of this class of aircraft is usually determined by a probability of departure from controlled flight if the aircraft is inadvertently pushed to an extreme angle of attack condition. Historically, these limits have been defined in flight test with attendant risk of aircraft loss. The objective of this effort is to develop design guidelines for fighter aircraft to operate safely at high angle of attack based on existing experimental data. Rational criteria for design of air combat aircraft in the extreme angle of attack range is a requisite for improved flight safety and combat effectiveness.

Existing wind tunnel data on the F-16 and F-111 series aircraft configurations will be collected, correlated and analyzed for trends and sensitivities of flying-quality parameters to geometry changes. Special attention is to be given to forebody shape and strake geometry effects which are responsible for much of the non-linear character observed at high angles of attack.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXMC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0003, AERONAUTICAL TECHNOLOGY, TECHNICAL AREA K - FLIGHT SIMULATION
I.C. STATLER, U.S. Natl. Aero. & Space Adm., Ames Research Center, *Moffett Field, California* 94035 (DA0D5004)

Perform analyses and design studies of the requirements of a rotary-wing R&D flight simulator capable of simulating NOE flight operations. Available simulation technology allows a total integrated systems approach to R&D involving conceptual designs, preliminary and detail design trade-offs, man-machine interactions, mission capabilities, support of flight tests, and product improvement evaluation.

In joint participation with NASA, perform the studies with the expectation of modifying an available NASA simulator to meet the Army's mission requirements.

ADDENDA: Supporting agency address is: AVRADCOM Air Mobility R&D Lab, Ames Dir, Ames Rsch Ctr, Moffett Field CA 94035

SUPPORTED BY U.S. Dept. of Defense, Army

1.0004, INSTALL AND REPAIR HARDWARE ON COAST GUARD AIRCRAFT, VESSELS OR VEHICLES, AND LORAN-C NAVIGATION SYSTEMS
UNKNOWN, Teledyne Systems Company, *Northridge, California* 91324 (CG59269; CG-63,095-A)

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary

1.0005, NAVY VEHICLE DESIGN AND CONSTRUCTION - IDENTIFICATION OF AIRCRAFT STABILITY AND CONTROL DERIVATIVES
W.E. HALL, Systems Control Incorporated, *Palo Alto, California* 94306 (DN223377; N00014-72-C-0328)

Research into advanced parameter identification technology is being performed. The objective is to develop new analytical methods upon which to implement expanded on-line and off-line parameter identification algorithms for extracting values of aircraft stability and control parameters from flight test data. The need for such technology stems from the requirement to reduce costs associated with design, testing and certification of military aircraft; provide input to ground simulators, and provide a basis for advanced flight control system design.

High-angle-of-attack flight test data from tests performed using the Naval Air Development Center's (NADC) variable stability T-2C aircraft will be processed using the nonlinear systems identification algorithms develop under this project.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

1.0006, NOISE MONITORING SYSTEM
UNKNOWN, E G & G Incorporated, *San Diego, California* 92160 (FA77WA-3924; FA59972 (TRAIS NO.))

A noise monitoring system will be installed at Dulles International Airport.

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary

1.0007, COMPRESSOR SHROUD SEAL
J.W. VOGAN, Internat. Harvester Company, *San Diego, California* 92101 (DF459960; F33615-77-C-2022)

Determine energy transfer between a stator and drum rotor during a rub.

Perform rig-type testing using different (1) rub materials, (2) blade materials, (3) interaction rates/incursions, (4) rotor speeds. Perform an analysis on the heat generation and include this in the NASA rub energetics program.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory TBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0008, INVESTIGATION OF CENTRIFUGAL EFFECTS ON TURBINE ROTOR FILM COOLING
M.J. BLAIR, United Technologies Corp., *Hartford, Connecticut* 06108 (DF461600; F33615-77-C-2068)

Determine the influence of centrifugal force on the coolant film distribution on a rotating turbine blade. Analysis indicates that where free-stream velocity is low, e.g., the stagnation region, the induced radial velocities signficantly alter the expected coolant distribution.

Determine coolant trajectories on a rotating blade using flow visualization techniques, then measure heat transfer to the rotating blade with instruments located per the visualization tests.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory TBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0009, ENGINEERING SUMMARY OF POWERPLANT ICING TECHNICAL DATA
UNKNOWN, United Technologies Corp., *Hartford, Connecticut* 06108 (FA59307; FA76WA-3840)

Report No. ADS-4, Engineering Summary of Airframe Icing Technical Data, was issued in 1964 as a reference document for airframe design engineers to use in designing airframe ice protection systems. Information relating to the design of powerplant anti-icing and de-icing systems is not presented in the report. It is the objective of this contractual effort to provide for a report supplementing Report No. ADS-4 which can be used by powerplant design engineers in designing powerplant ice protection systems.

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary

1.0010, DEVELOP STANDARD TECHNIQUES FOR ANALYSIS OF AIR TRAFFIC IN NATIONAL AIRSPACE SYSTEM
L.B. WARD, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (FA76WAI-594; FA59551 (TRAIS NO.))

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary

1.0011, SMOKE MEASURING INSTRUMENTATION SYSTEM
H. WHEELOCK, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (4928386 (NBS NO.))

PURPOSE: Provide for FAA a complete 20 channel calibrated smoke measuring system, as developed in the Program for Fire Detection and Control Systems (PFDCS), that can be used to study the buildup of smoke in an aircraft cabin.

OBJECTIVES: PFDCS and NBS Instrument Shops will design, construct, calibrate, deliver and supervise the installation of the smoke measurement system. Prepare a Methodology Manual in FAA containing design, construction, installation, calibration, operation and maintenance information and a parts list.

FY 77 MILESTONES: Completion of work in 4 months following NBS acceptance of the agreement. Completion of system and manual - 4/77. System installed in FAA test facility - 5/77.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin., Systems Research & Development Service

1.0012, AEROSAT USER'S AIRBORNE SYSTEMS INTEGRATION AND DATA COLLECTION
UNKNOWN, Arinc Research Corporation, *Annapolis, Maryland* 21401 (FA58668; FA75WA-3686)

This multi-year program includes an evaluation of the factors necessary to make the L-band and VHF avionics tests comparable and the assessment of cost factors associated with the AEROSAT avionics program. A preliminary design study will determine the installation requirements. This includes a continuing review of both the L-band and VHF specification parameters as applicable to installation in air carrier aircraft. A detailed design study will be followed by the installation of one airborne system in a selected aircraft type and flight tests of the complete system.

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary

1.0013, TRANSONIC UNSTEADY WIND TUNNEL MEASUREMENTS ON AN OSCILLATING WING WITH TIP STORES
H. TIJDEMAN, Natl. Aerospace Laboratory, *Amsterdam, Netherlands* (DF140100; AF-AFOSR-3233-77)

This work unit supports the aeroelastic evaluation of high-speed aircraft. It will contribute to the development of improved unsteady aerodynamic methods to predict aircraft aeroelastic stability and structural dynamic response. The goal is to conduct unsteady aerodynamic tests on oscillating models in transonic wind tunnels, resulting in ultimate savings in the costs to design new aircraft. The capability to make these measurements will allow the orderly development of necessary analytical methods to optimize aircraft structures for minimum weight and cost.

The proposed effort is to perform transonic unsteady wind tunnel measurements on an oscillating wing with external stores. The objective is to obtain experimental data to guide improvements in transonic unsteady theories which will be used to ascertain flight safety of future air-combat fighters with respect to wing flutter.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBRB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0014, AIR CUSHION SYSTEM DEVELOPMENT/TEST/EVALUATION
J.T. STEIGER, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF140720)

This effort supports the development of an air cushion landing system (ACLS) and other air cushion systems (ACS) for the launch and recovery of remotely piloted vehicles (RPV), which are projected to significantly reduce RPV life-cycle costs and to provide new expanded RPV mobility, and the development of an alternate aircraft takeoff system (AATS) which will enable conventional fighter aircraft to be rapidly launched after enemy weapons/bombs have caused extensive airfield damage. The objective of this effort is to accomplish in-house development, test and evaluation in support of RPV ACLS, RPV ACS launch and recovery, and fighter aircraft AATS systems development. RPV ACLS and RPV ACS concepts are expected to reduce RPV launch/recovery costs by 80 percent and turnaround time by 90 percent, and provide uncelled RPV mobility. AATS will provide ability to immediately launch fighter aircraft after an enemy attack on their air base.

In-house development, test and evaluation work will be done in support of the following phases of development for the named systems: (1) RPV/ACLS preparation for and accomplishment of ground and flight tests, (2) RPV ACS concepts definition and initial development, and (3) fighter aircraft AATS concept definition and initial development.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FEM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0015, FLIGHT LOADS SIMULATION CAPABILITY
F.K. BOGNER, Univ. of Dayton, School of Engineering, *Dayton, Ohio* 45409 (DF138400; F33615-76-C-3135)

There is currently no facility in existence in the free world in which flight loads on an aircraft structure can be realistically simulated during a ballistic impact on the structure. Also, it is presently very difficult, if not impossible, to determine residual strengths of large sections of aircraft structure after they have been damaged by ballistic impact. The objective of this effort is to design and fabricate a loading system which will have the dual

capability listed above. Development of such a facility will result in greatly improved simulation during survivability/vulnerability tests on USAF aircraft.

A contractor will be selected through a multiple source procurement to perform this effort. The contractor will design and build the loading system which will be installed in the AFFDL vertical gun range. In addition, the contractor will supply test specimens which will be tested in the facility to evaluate its performance. The contractor will also develop an analysis capability as a part of this effort which can be used to predict stresses and probable points of failure in ballistically damaged aircraft structure.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FES, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0016, CONFIGURATION AERODYNAMICS FOR SINGLE ROTOR HELICOPTERS

P. SHERIDAN, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0D4104; DAAJ02-77-C-0020)

Investigate single rotor helicopter configuration interactional aerodynamics and develop a set of generalized configuration guidelines for design and operation of single rotor helicopters.

Reduce existing wind tunnel test data of a 1/5th scale UTTAS model (YUH-61A) and segregate according to aerodynamic interactions--analyze test data and plot significant parameters and develop design guidelines for the various aerodynamic interactions.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R&D Lab, Eustis Dir, Ft Eustis VA 23604

SUPPORTED BY U.S. Dept. of Defense, Army

1.0017, VALIDATION OF MODEL TO SIMULATE AIRCRAFT SEAT AND OCCUPANT IN A CRASH ENVIRONMENT

UNKNOWN, Penn. State University, Graduate School, *University Park, Pennsylvania* 16802 (FATQNA-3037; FA59704 (TRAIS NO.))

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary

1.0018, INVESTIGATION OF THE TRANSIENT ASPECT OF HYDROPLANING

UNKNOWN, Penn. State University, Graduate School, *University Park, Pennsylvania* 16802 (OS59214; OS-60145)

Hydroplaning is the condition under which a continuous waterfilm separates the aircraft tire from the pavement on a flooded runway. Friction is at a minimum and loss of control results. This research will answer the following questions: (1.) Are the conditions under which hydroplaning is sustained adequate for inducing hydroplaning? (2.) What are the conditions for transition from quasi-dry contact to full hydroplaning? (3.) Does the friction force go through a minimum just before full hydroplaning is reached? (4.) How long, in time or distance, does the transient condition during partial hydroplaning last, and what is the minimum time or distance for full hydroplaning to develop?

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary

1.0019, DEVELOPMENT OF A SYSTEM PERFORMANCE MODEL FOR THE VEGA EXPERIMENTAL PILOT WARNING INSTRUMENT

UNKNOWN, U.S. Navy, Underwater Systems Center, *Newport, Rhode Island* 02840 (RA-74-9; TS45914 (TRAIS NO.))

The following tasks will be accomplished: a) Review and evaluate the Vega Precision Laboratories, Inc. proposal for a Pilot Warning Instrument experimental system. At the completion of the review cycle, develop a systems performance model that establishes the relationships between the critical system factors and achievable performance. b) Use the completed performance model to derive the specifications for performance evaluation criteria and test measurement techniques.

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary

1.0020, LEADING EDGE DESIGN STUDY FOR SWEPT-BACK SLENDER WINGS WITH OR WITHOUT SEPARATION

R.K. NANGIA, Univ. of Bristol, *Bristol, England, United Kingdom* (DF140640; AF-AFOSR-3243-77)

In the design of high-performance fighter aircraft having large wing sweep, compromises occur in meeting the constraints of efficient high-speed cruise and good transonic maneuverability. Careful design of the leading edge geometry can lead to significantly improved wing performance (lift-drag ratio) in both speed regimes. Applying droop in the leading edge region by means of flaps, variable camber devices, or slats can lead to improvements although in general optimum geometric shapes must be found by trial and error. Leading edge design is further complicated for this class of wings by the possibility of flow separation and subsequent vortex formation. The object of the study is to provide guidelines to be used in designing leading edges of high-sweep wings in order to achieve the maximum aerodynamic efficiency.

A theoretical method will be developed to calculate the flow field for non-planar, highly swept wings of finite thickness having either separated or attached flow at the leading edge. The problem will be simplified by making the assumption of conical flow thereby allowing the problem to be reduced to a 2-d solution in the cross-flow plane in which conformal transformation techniques can be introduced. Leading edge separation will be analyzed with a Brown and Michael - type model for the free, rolled-up vortex sheet. This relatively simple approach will provide the means to investigate the details of the flow near the leading edge for a large number of cases at mimimum computational cost.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXMA, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, A STUDY OF THE REDOX PHOTOCHEMISTRY OF A NUMBER OF IRON COMPLEXES

J.L. REED, Atlanta University, School of Arts & Sciences, *Atlanta, Georgia* 30314 (NSG 8019)

The electron transfer photochemistry of a number of ferrous and ferric complexes and other relevant d6 systems is under investigation. It is our hope that such compounds will prove useful in converting solar energy into usable forms such as electrical and chemical potential energy. Toward this end we are examining the behavior of iron complexes with the goal of constructing a model for their photochemical behavior. Such a model will permit investigators to design iron complexes for this purpose and to determine the optimum conditions for their use.

Of interest in this regard is the determination of the effects of several variables on the photochemical behavior of the compounds under investigation. Several of these are: the effects of ligation on photochemical behavior, what promotes electron transfer at longer wavelengths, what enhances complex stability toward substitution and oxidation. It would also be of interest to know what type of electron acceptors, in the case of ferrous complexes, or donors, in the case of ferric complexes, are most efficient. Our approach will be to screen a number of such compounds and to determine by steady-state photochemical techniques the details of the mechanisms operative in these systems.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0002, CHARACTERIZATION OF THE PHYSICO-CHEMICAL PROPERTIES OF POLYMERIC MATERIALS FOR AEROSPACE FLIGHTS

M. ROCK, Bowie State College, Graduate School, *Bowie, Maryland* 20715 (NSG 5009)

Materials of interest to Goddard Space Flight Center are routinely tested in a vacuum at 125 degrees C, at Greenbelt, to determine their outgassing properties. This affects their suitability for use in space modules. It is our object to extend the range of these tests to higher and lower temperature ranges than those usually run at Goddard Space Flight Center. Further, we have the capability of testing materials in air or inert atmosphere as well as in vacuum.

We use a Dupont 900 Differential Thermal Analyzer (DTA) and an auxiliary Dupont 950 Thermogravimetric Analyzer (TGA). The TGA enables us to measure outgassing - via weight loss - from 20 degrees to 500 degrees C. The DTA indicates exothermic and endothermic changes over the same range.

We are currently running the standard DTA and TGA tests. We are also trying to develop a method to extend the range of the DTA down to -196 degrees C (77 degrees K).

We have been making good progress in that during the past year we have increased the type of tests and have extended the limit of the temperature parameter of tests we run. We have provided this service (through the program moderator) to several people at Goddard Space Flight Center.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0003, VACUUM ULTRAVIOLET PHOTOACTIVATION OF MOLECULAR NITROGEN

J. BRAGIN, Calif. State Univ. & Colleges, School of Letters & Science, *Los Angeles, California* 90032 (NSG 7261)

OBJECTIVES: To determine whether photoactivation of molecular nitrogen by vacuum ultraviolet radiation of N2/CH4 mixtures, under conditions simulating the environments of the outer planets and their satellites, results in detectable concentrations of compounds containing both carbon and nitrogen, especially HCN.

To determine the effect on the photolysis products of variations in excitation wavelength, irradiation time, and initial composition of the reaction mixture.

APPROACH: Irradiate mixtures of commercial gases simulating the best current models of outer planet atmospheres (including Titan) and to analyze the products by gas chromatography and mass spectrometry.

CURRENT STATUS: No compounds containing C-N bonds were detected; however, the expected photopolymerization of CH4 did occur. The grant expired 12/31/76 and was extended to 6/30/77. It was concluded that additional studies in which quantitative estimates of the effective UV flux are needed before the possibility of vacuum UV photoactivation of molecular nitrogen under simulated outer planet conditions can be definitely excluded as a likely naturally occurring process.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0004, THE DEVELOPMENT OF SUPEROXIDES AS IMPROVED OXYGEN SOURCES FOR BREATHING APPARATUS

L.A. SPITZE, Calif. State Univ. & Colleges, School of Natural Sci. & Math., *San Jose, California* 95192 (NSG 2066)

This program is concerned with the development of new chemical sources of breathing oxygen for application in portable, lightweight, and self-contained breathing apparatus. The work has centered on calcium superoxide, Ca(O2)2, a material difficult to prepare but superior to alternate materials in proportion of available oxygen, capacity for carbon dioxide, and ability to function efficiently without caking or overheating. Experiments have produced calcium superoxide in higher purity than any previously reported. Process scale-up has been attempted and critical process scale-up parameters have been identified. Inert gas flow through a partially fluidized reactant bed has been used for temperature control and evolved water removal. This approach is being continued with a larger fluidized bed apparatus.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0005, PREPARATION AND TESTING OF FIRE EXTINGUISHMENT CHEMICALS SUITABLE FOR ENGINE NACELLE FIRE CONTROL IN AIRCRAFT

A.C. LING, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NCA 2-675706)

The scope of this joint research program is the laboratory scale preparation and testing of new fire extinguishing agents suitable for the suppression and control of fires in jet engine nacelles under conditions of high airflow. New and different fire extinguishant chemicals will be synthesized and tested with a view to being able to tailor chemicals and delivery methods to specific fire situations encountered in aircraft jet engine nacelle fires.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0006, HOT SURFACE IGNITION TEMPERATURE OF AIRCRAFT HYDRAULIC FLUIDS

D.J. MYRONUK, Calif. State Univ. & Colleges, School of Engineering, *San Jose, California* 95114 (NSG 2219)

The objective of the study was to determine the minimum magnitude of surface temperature for hot surface ignition and subsequent burning characteristics of conventional combustible and special ignition-resistant hydraulic fluids as influenced by: (1) heated surface material (stainless steel) (2) dynamic burning conditions (air flows over the hot surface ranged from 0 to 40 meters per second) (3) fuel application pressures (droplets at atmospheric pressure to sprays at 6.9 M Pa (1000 psi). A 3 inch pipe heated internally with an air/propane flame, was located in a trough which in turn channelled air over the outer pipe surface. Metal strips projecting from that surface acted as flame holders when fluids sprayed into the upstream air were ignited by the hot surface.

Three performance categories have been established based upon minimum temperature to ignite the fluid at very low air speeds and the influence of air flow speed on surface T, required to ignite the fluid. Higher speeds required higher surface temperatures. The best performance was a phosphate ester, Skydrol 500B, which ignited at 725 degrees C but proceeded to burn vigorously at 900 degrees C for air speeds of 40 m/sec. The hydrocarbon based fluids, H-5606 and H-83282, ignited at 575 degrees C and 500 degrees C respectively; also they burned vigorously at 825 degrees and 800 degrees C at air speeds of 40 m/sec. The allegedly more flame-resistant 83282 did not perform that way. The silicone-based candidates yielded unexpected results. While they could resist ignition at air speeds above 10 m/sec for surface T's exceeding 900 degrees C, at low air speeds they ignited at about 425 degrees C. Especially noteworthy were observations that a lubricant added to the silicones made the base fluid easier to ignite. The phosphate esters and silixanes in the process of burning, produced a tenacious surface material which can in turn act as its own flame holder. This would generate a vigorous flame site with potential for burn-through and/or structural damage in locations normally free from fire sites by virtue of the dynamic local airflows.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0007, A STUDY OF PROCESSING PARAMETERS FOR NON-METALLIC COMPOSITES

A.C. LING, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NSG 2209)

The objective of this grant is to investigate the physical parameters of organic polymers for use in fire-resistant structures for aircraft. The approach is to study properties such as strength, resistance to moisture, fire retardancy, and smoke evolution and

relative toxicity when burned of polymeric materials. To date test methods have been established and some properties of newly developed polymers have been evaluated.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0008, DIFFUSION PARAMETERS OF WATER AND SOLUTES IN SPECIAL MEMBRANES USEFUL FOR CLOSED SYSTEM WASTE WATER PURIFICATION

L.A. SPITZE, Calif. State Univ. & Colleges, School of Natural Sci. & Math., *San Jose, California* 95192 (NGR 05-046-011)

The proposed work continues the study of transport parameters of water and selected solutes through cast polymer membranes and plasma polymerized composite membranes.

This is a continuation of the work in progress and described in NGR 05-046-011, Supplement No. 5. Radiotracer permeability measurements using tritiated water and various tagged solutes will be continued. Two circulating high-pressure reverse-osmosis test systems are available and one will be used to screen membrane production, while the other, a nominally 'hot' system, will be used to study the flux and rejection of radiotracer species under reverse-osmosis test conditions. A plasma (radio frequency discharge) system for the deposition of polymer coatings has been in operation and will be used to study conditions of (1) membrane reproducibility and (2) optimization of water flux and solute rejection. An osmotic test cell for null volume flux measurements is being modified. The effect of variation of membrane composition and deposition parameters on urea flux and rejection is of particular interest.

The work will be conducted in close cooperation with the needs and goals of the water purification project being conducted at NASA-Ames Research Center.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0009, PREPARATION OF THERMALLY STABLE DRY CHEMICALS

A.C. LING, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NSG 2223)

Fire extinguishant chemicals in current use for combating jet engine nacelle fires which are called HALONS have very high vapor pressures at 500 degrees F (260 degrees C) and are in general thermally unstable with prolonged storage at such high temperatures. Since dry powders can have lower vapor pressures and can be more thermally stable than liquids or gases we have undertaken this program to find and develop new dry chemical fire extinguishants of greater weight effectiveness, greater thermal stability and of lower vapor pressure than the HALONS at 500 degrees F. A previous study showed that alkali metal carbonates, halides and hydroxides seemed to be most capable of fulfilling these requirements.

The present study has undertaken the laboratory-scale development and characterization of dry chemical fire extinguishants meeting these goals. The characterization is by chemical analysis of elements and radicals contained in the dry chemical preparations obtained by both mechanical mixing and chemical reaction and by thermogravimetric analysis of these same preparations. The development includes pulverization, particle-size and bulk-density determination and optimization of these parameters by addition of other inert materials in small quantities.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0010, PRELIMINARY STUDY OF RETICULATED FOAM SURVIVABILITY CHARACTERISTICS

H. SHARFSTEIN, Calif. State Univ. & Colleges, School of Engineering, *San Jose, California* 95114 (NSG 2200)

Major objectives of the study were acquisition, organization, verification, and analysis of available data on physical and chemical properties of reticulated polyurethane (polyester and polyether) foams used in military aircraft fuel tanks to prevent fuel sloshing and for fire/explosion protection. The data acquisition phase of the project involved assimilation of data from numerous sources, including: government reports, technical journals, and in-house data generated by both environmental degradation (accelerated temperature and humidity testing) of polyester and polyether reticulated foams revealed problems in reproducibility of data. Correlation coefficients were low in many cases, posing questions with respect to aspects of standard test procedures. Specific revision of the test procedure, sample sizes and minimum number of samples are proposed.

Degradation rates for polyether foams were significantly slower than for polyester foams under accelerated temperature and humidity testing conditions. Polyether foams showed larger swell volumes and reduction in tensile strength in a fuel environment.

Preliminary data on inservice polyester foam properties are reported and further data collection in this area is recommended. Based on this work, other recommendations for further study include: correlation of inservice foam data with better laboratory data resulting from the improved testing procedures and studies of the mechanisms of fire suppression in the foam.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0011, CHARACTERIZATION AND FORMULATION OF FLUOROCARBON ETHER ELASTOMERS

J.A. NEPTUNE, Calif. State Univ. & Colleges, School of Natural Sci. & Math., *San Jose, California* 95192 (NSG 2186)

Our objective is to thoroughly characterize several fluorocarbon ether elastomers for use as high-temperature sealants. Spectroscopic, chromatographic, thermogravimetric, kinetic, calorimetric, and mechanical methods of analysis are being used to determine optimum conditions of elastomer synthesis and limits of application.

We have successfully made linear poly(oxadiazole fluoroether) with a weight averaged molecular weight of 20,000. This polymer has excellent low-temperature flexibility and sufficiently high molecular weight to give an elastomer of high thermal stability and low modulus when crosslinked.

A technique for simultaneous chain extension and crosslinking was developed whereby oxadiaxole and triazine fluoroethers are synthesized. Elastomers formed in this way have a glass transition temperature of -50 degrees C, a low modulus that can be adjusted by controlling the crosslinking density, a sol fraction as low as 1%, and excellent thermal stability. Elastomers can be formed on a titanium surface by application of the viscous prepolymer and heating at 150-200 degrees C.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0012, ANALYTICAL/EXPERIMENTAL STUDY OF PASSIVE FIRE PROTECTION SYSTEMS

F. HOLMSTROM, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NSG 2224)

The National Aeronautics and Space Administration (NASA) is conducting a program for the development of passive fire protection systems for lightweight Navy ships. A principal requirement of the systems is high-level protection per unit weight, as well as the standard requirements of marine applications including high durability, negligible toxic gas and smoke production, resistance to corrosion from salt and humid atmospheres, and many others. The required high protection level per unit weight is being achieved by a technique which incorporates air into the system, and which thereby utilizes the low thermal conductivity of air with no added weight to the system. Specifically, the protection system is comprised of numerous 'thin' insulative layers, with an air gap separating each layer. NASA has developed a mathematical model of this system containing air gaps, and a number of optimum designs have been analytically determined. NASA is conducting an experimental fire testing program to verify the performance of these systems. This grant is a study whose principal purpose is to relate the

mathematical and experimental findings for these types of protection systems. At this time, approximately one half of the planned experiments have been conducted, and there has been excellent agreement between experimental and mathematical results. On the basis of these results, it appears that the new technique can lead to practical protection systems whose protection per unit weight is 3 to 5 times greater than commercial state-of-the-art systems.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0013, MODIFICATION OF POLYMERIC SUBSTRATA FOR THE GAS CHROMATOGRAPHIC ANALYSES OF CO, CARBONYLS AND O2 IN ATMOSPHERES

L.A. MAYER, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NSG 2237)

STATEMENT OF THE PROBLEM: To chromatographically separate and identify the components of planetary gases with emphasis on carbon monoxide, carbonyl, and oxygen. In order to analyze light gases successfully, all gaseous constituents must be adequately separated from each other. Examples of generally difficult separations include N2/CO, Ar/CO, N2/O2, Ar/O2. Carbonyl (C double bond O) containing molecules are expected to be found along with hydrocarbons, nitrilic species and amines, from which they will have to be separated. With deliberate and controlled retardation of the oxygenated species, the problems of peak coincidence can be resolved. The gases that are being described are those anticipated in the analysis of planetary atmospheres during future unmanned missions.

GENERAL APPROACH TO BE APPLIED: Separation and identification via gas chromatography, an instrumental technique that is based on differential flow characteristics of gases as they pass through capillary columns containing various types of substrates. In this proposal evidence will be presented demonstrating the feasibility of using a cobalt chelate compound on a vinyl benzene polymer to carry out the separations mentioned above on a short (4 ft.) gas chromatographic column.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0014, EXPERIMENTAL STUDY OF PASSIVE FIRE PROTECTION SYSTEMS

R. ANDERSON, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NSG 2235)

The National Aeronautics and Space Administration (NASA) is conducting a program for the development of passive fire protection systems for lightweight Navy ships. A principal requirement of the systems is high-level protection per unit weight, as well as the standard requirements of marine applications including high durability, negligible toxic gas and smoke production, resistance to corrosion from salt and humid atmospheres, and many others. The required high protection level per unit weight is being achieved by a technique which incorporates air into the system, and which thereby utilizes the low thermal conductivity of air with no added weight to the system. Specifically, the protection system is comprised of numerous 'thin' insulative layers, with an air gap separating each layer. NASA has developed a mathematical model of this system containing air gaps, and a number of optimum designs have been analytically determined. An experimental fire testing program is being conducted to verify the performance of these systems. The primary objective of this grant is to perform the experiments required to evaluate the relationships between the mathematics and the physics of such insulative systems. At this time, approximately one half of the planned experiments have been conducted, and there has been excellent agreement between experimental and mathematical results. On the basis of these results, it appears that the new technique can lead to practical protection systems whose protection per unit weight is 3 to 5 times greater than commercial state-of-the-art systems.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0015, SPECIFIC HEAT OF PLATINUM AND PLATINUM ALLOYS

E.M. HELMY, Delaware State College, Undergraduate School, *Dover, Delaware* 19901 (NGR 08-002-001)

We have determined the specific heat of Pt90Ir5Au5 and Pt80Ir10 Au10 and pure Pt, over the temperature range 0.4 degrees K to 30 degrees K. The results are analysed as an electronic contribution (gamma T) and a lattice contribution from which OD is determined as a function of temperature. The values of 6.32 mJoules/mole-degrees K for gamma and 223 degrees K for OD for Pt agree well with published values. The value of gamma for Pt90Ir5Au5 is unexpectedly lower (5.75 mJoules/mole-degrees K2) than for Pt while for Pt80Ir10Au10 agreement with Pt is good. Values of OD for both alloys are close to those of Pt for the full temperature range. Similar results have been observed in recent measurements on Pt-Au-Rh alloys. The results for gamma will be compared with rigid-band and charge transfer theories.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0016, HIGH-TEMPERATURE KINETIC STUDIES OF COMBUSTION OF HYDROCARBON USING A CHEMICAL SHOCK TUBE

C.E. HUNTER, Hampton Institute, Graduate School, *Hampton, Virginia* 23368 (NSG 1086)

A kinetic study of the combustion of propylene at temperatures between 950 and 1400 degrees K has been undertaken using a chemical shock tube. Measurements on the concentration profiles of the hydroxyl radical, oxygen atom, carbon monoxide and carbon dioxide are being monitored in order to deduce a kinetic scheme for modeling the propylene-oxygen system. Current rate constant and kinetic data have been evaluated and a mechanistic scheme developed. At low temperature, the predominant dissociative mechanism is the reaction of propylene with molecular oxygen to produce the hydroperoxide and the alkyl radicals. As one approaches the second explosion limit of the propylene-oxygen system, the third-body collision reaction forming the alkyl-peroxide radical gains kinetic significance.

The concentration of oxygen atom is obtained by monitoring the chemiluminescent reaction of CO2 at 3800 A using a one-half meter vacuum-ultraviolet polychromator.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0017, STRUCTURE OF SPACE-RELATED MATERIALS

S. SINGH, Howard University, School of Liberal Arts, *Washington, District of Columbia* 20001 (NSG 5186)

The structures of several space-related materials are currently being investigated with special emphasis on the thermal expansion of these structures. Work is currently in progress on several rare-earth oxides, orthoferrites, and iron garnets of rare earths. Materials are prepared in this laboratory and these studies are being made as a function of temperature (300-4.2K) using an absolute method of precise parameter determination and cameras developed by this laboratory.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0018, AQUATIC PLANTS AS FILTRATION SYSTEMS FOR CHLORINATED HYDROCARBONS

F. SHORE, Jackson State University, School of Liberal Arts, *Jackson, Mississippi* 39217 (NSG 8026)

The purpose of this proposed research is to: (1) evaluate the effectiveness of aquatic plants in removing chlorinated hydrocarbons from water; (2) evaluate possible agents to encourage the above removal such as soaps and detergents; and (3) examine plants for metabolites of chlorinated hydrocarbons.

Initially water hyacinths, Eichhornia crassipes (Mart). Solms will continue to be investigated with the halogenated hydrocarbons chloroform, hexachloroethane, Toxaphene and Mirex.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0019, MATRIX-ISOLATION-INFRARED AND LASER-RAMAN SPECTROSCOPIC STUDIES OF SHORT-RANGE INTERMOLECULAR FORCES

J.H. HALL, Morehouse College, Graduate School, *Atlanta, Georgia* 30314 (NSG 8049)

OBJECTIVE/APPROACH: The primary objectives of this project are to study and characterize the nature of the intermolecular interactions between molecules trapped in matrices at 4.8K. Both infrared and Raman spectroscopy are employed in these studies.

The general procedure is to trap molecules in matrices of different concentrations. The intensity of ir and Laser-Raman absorptions which are due to intermolecular interactions are inversely proportional to the matrix concentration.

We describe here our preliminary results on CO2 and freon-12: Infrared spectra of the molecules freon-12 and carbon dioxide have been studied in the gas, the condensed, and the matrix-isolated phases.

The matrix-isolation studies of freon-12 and CO2 were performed with argon, nitrogen, and sulphur-hexafluoride as matrices. The most suitable matrices for our study were found to be argon and nitrogen, because the sulfur hexafluoride and carbon dioxide absorbation peaks overlapped strongly with the freon-12 spectra.

Matrix material to active material ratios were varied from 50:1 to 10,000:1.

Condensed phase studies were performed by depositing the molecule in question, both at 10K and at its melting point.

Freon-12: Our gas phase spectra for freon-12 are in agreement with previously published data. Condensed phase spectra show an interesting feature at 760/cm, which we have tentatively assigned to intermolecular interactions. Most of the absorptions have been assigned to fundamental and combination bands. The isotopic shifts for Cl35 and C13 are readily observed and have been assigned.

Carbon dioxide: The fundamentals of CO2 were observed as well as the isotopic shifts due to C13, O18 or O17. All efforts to assign absorbation peaks due to a 'CO2 dimer' were unsuccessful. Experiments are now underway to study various mixtures of 18CO2 and 16CO2 in matrix isolated form in order to establish the order of magnitude of the intermolecular interactions.

We are now performing laser-Raman-matrix-isolation studies of F-13, F-12, Co2, NH3, O3 and O2. These types of experiments have not previously been attempted.

Theoretical models for intermolecular interactions in matrices are also being developed. These models should aid immensely in our interpretration of the spectra. (Text abridged.)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0020, INCREASING ADHESION OF (2.2) PARACYCLOPHANE POLYMERS TO EPOXY GLASS LAMINATE SURFACES

F. WEAVER, Morris Brown College, Undergraduate School, *Atlanta, Georgia* 30314 (NSG 8027)

This project seeks to increase the adhesion of (2.2) paracyclophane polymers to epoxy glass laminate surfaces by incorporating polar substituent groups in the aromatic ring of the linear paracyclophane polymer. The appropriate substituents (acetyl trifluoromethyl, bromo, carboxamide) are synthetically substituted in the monomer precursor, which is subsequently polymerized. We have taken several approaches toward the synthesis of the appropriately substituted monomers, electrophilic substitution reactions of (2.2) paracyclophane, and cyclization reactions starting from reactants other than (2.2) paracyclophane. The latter class of cyclization reactions is being investigated at present. To date we have prepared and characterized four substituted paracyclophane monomers: dibromo, tetracarbomethoxy, nitro, acetyl and the tetra-carboxylic acid-substituted (2.2) paracyclophanes.

Efforts are just beinning to study the ease of pyrolysis of these substituted (2.2) paracylophanes to the quinodimethane intermediate.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0021, STUDY OF COMPOSITES AS SUBSTRATE MATERIALS IN LARGE SPACE TELESCOPES

A.V. SHARMA, North Carolina A & T St. Univ., School of Engineering, *Greensboro, North Carolina* 27411 (NSG 8045)

A feasibility study on the use of graphite composites as substrate materials in the design of precision mirrors is being conducted. Preliminary literature survey has been completed. Typically, a precision mirror substrate for space-oriented applications should possess good dimensional stability, polishability, low thermal expansion, high thermal diffusivity, high specific modulus (elastic modulus/density ratio), homogeneity, clarity for inspection, size- and lightweight-capability.

Preliminary search indicated that graphite/epoxy (G/E) composite system may not be suitable to develop precision reflecting surfaces. Formation of voids and the tendency of G/E composites to absorb moisture were considered partly responsible to dimensional instability. While it is known that G/E composites can be designed to develop zero in-plane coefficient of thermal expansion, the thermal expansion perpendicular to the laminate plane would become critical for precision reflecting surfaces. Consequently, further literature search is being performed to assess the potential that matrix materials such as polyimides and polysulphones are known to have. Composites fabricated with these matrices are expected to have fewer voids and less hygroscopic tendency as compared to G/E system. Other substrate design options such as sandwiching graphite composites with ULE faceplates, unidirectional fiber composite core with graphite composite faceplates, etc., are also under investigation. Adhesive selection, encapsulating techniques, and other related areas are also being investigated.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0022, EVAPORATION BEHAVIOR OF SUPERALLOYS

R.P. RAMIREZ, Tuskegee Institute, Graduate School, *Tuskegee Institute, Alabama* 36088 (NSG 3154)

OBJECTIVE: To study the evaporation behavior of several selected superalloys at high temp. (700 degrees C-1100 degrees C) and high vacuum (approximately 10 to the minus 7th power torr). Rate of evaporation of each superalloy is to be established. Eventually this is to be followed by establishment of order and magnitude of evaporation of each component evaporating from samples tested. Ultimate objective is to improve current superalloys for high-temperature applications in outer space.

APPROACH: First step involves the design of an effective vacuum chamber-furnace and corresponding vacuum pumping system with appropriate accessories. Then 4 complete systems will be pondered, fabricated and prepared for testing. Specially designed specimens are to be submitted to long-range vacuum-heating cycles and weight losses determined periodically. Control parameters and variables are temperature, vacuum, specimen weight and test duration. In addition, collected vapors will be analyzed via Auger spectroscopy or electron microprobe.

CURRENT PROGRESS: Literature search is well in progress and entire system is nearly complete. Orders for system parts and/or components are now being prepared. Systems fabrication will take place as soon as parts arrive and above investigations will be undertaken soon thereafter.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0023, ENVIRONMENTAL STRESS CRACKING OF POLYMERS

K.J. MAHAN, Univ. of Southern Colorado, Graduate School, *Pueblo, Colorado* 81001 (NSG 806)

Environmental stress cracking (ESC) has been described as the Achilles' heel of polymeric materials. The objective of this project has been to test a variety of polymeric materials for susceptibility to ESC and gather data that will allow the elucidation of a mechanism for this phenomenon. Previous studies have indicated that ESC is a critical phenomenon: at some critical stress the cracking transforms from an instantaneous to a time-dependent phenomenon. Unfortunately experimental curves from which these conclusions were drawn are in most cases based on a minimal number of experimental points. Our approach to the problem has been to develop methods for testing specimens that allow a large number of experimental points (30 or more) to be used in the construction of the time to break vs. stress curves which allows a more precise treatment of the data. Progress made thus far on the project includes: 1) Preliminary evaluation of the tendency of a number of polymer/liquid systems to ESC, 2) Development of new test procedures, 3) Data from which time to break vs. stress curves have been constructed for 32 polymer/liquid systems many of which have never before occurred in the literature, and 4) Preliminary data on the temperature effects on ESC. Future plans call for the development of methods to study polymers that are resistant to ESC and detailed studies on the temperature effects on ESC. Data on temperature effects will be obtained over a range of -30 degrees C to 50 degrees C, using a variety of polymer/liquid systems. These data will allow calculation of activation energies for cracking that will be valuable along with the critical stress data in the elucidation of a plausible mechanism.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0024, ESR STUDIES OF VISCOUS LIQUID CRYSTALS

M.P. EASTMAN, Univ. of Texas, School of Science, *El Paso, Texas* 79902 (NSG 1316)

ESR lineshapes that are appropriate for vanadyl spin probes in viscous nematic liquid crystals have been calculated by the stochastic Liouville method for Brownian rotation and for Brownian rotation modified by the inclusion of fluctuating torques. In the fluctuating torque model the large liquid crystalline solvent molecules induce a slowly varying torque upon the smaller probe molecule. The inclusion of fluctuating torques improves the fit of calculated theoretical spectra to the experimental spectra. This improved fit is reflected in more precise values for the probe order parameter (S) and rotational correlation time (tau). For vanadyl acetylacetonate in phase V (EM Laboratories) the Brownian model yielded S equals 0.13 and tau equals 2.3 x 10 to the minus 10th power sec/rad at 69 degrees C and S equals -0.33 and tau equals 1.1 x 10 to the minus 7th power sec/rad at -26 degrees C. The results for the fluctuating torque model were S equals -0.11 and tau equals 1.1 x 10 to the minus 10th power sec/rad at 69 degrees C and S equals 0.36 and tau equals 9.2 x 10 to the minus 9th power sec/rad at -26 degrees C. Studies have also been carried out using other viscous nematic liquid crystals. The work reported here is being expanded to smectic liquid crystals. It is believed that these motional studies will provide information useful to individuals interested in liquid crystal electrooptic devices.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0025, DEFLAGRATION TO DETONATION TRANSITION IN HMX-BASED PROPELLANTS

M. COWPERTHWAITE, Stanford Research Institute, *Menlo Park, California* 94025 (DF047220; F49620-77-C-0039)

AF function - many of the energetic propellants required for present and future Air Force long-range delivery systems are explosively filled compositions that are capable of undergoing deflagration to detonation transition (DDT). Deficiency - the mechanism of DDT and the conditions for its initiation are not well understood. Objective - this research will develop a computational capability for assessing the DDT hazard in explosively filled propellants. How work contributes -establishing the conditions for the onset and building of DDT will safeguard against the destruction of the missile and the launching platform by detonation of the rocket motor.

Experimental and theoretical studies on HMX-based propellants will be made in order to obtain a fundamental understanding of DDT and formulate a satisfactory model for its description. In the experimental studies, ionization gages and multiple Lagrange stress gages will be used to measure flame speeds and the pressure fields ahead of the flame in propellants with and without a simulated crack field. These measurements will serve to determine conditions for the onset of DDT and elucidate its mechanism. The first task of theoretical study will be to formulate a physically realistic model for the flow produced by an unsteady flame. The results of the experimental studies will then be incorporated into the treatment of the unsteady flame to generate a satisfactory model for DDT.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0026, INVESTIGATION OF CONTROLLED NUCLEATION THERMOCHEMICAL DEPOSITION (CNTD) MECHANISM AND PROPERTIES

R.A. HOLZL, Chemetel Corporation, *Pacoima, California* 91331 (DF047780; F49620-77-C-0086)

AF function - ceramic materials are being developed for a variety of components (e.g. blades, vanes, combustors, bearings and seals) in future gas turbine engines and for a variety of electronic and optical components in aircraft. Opportunity - a new CVD-like process known as CNTD (controlled nucleation thermochemical deposition) has been developed for producing very fine-grained materials having superior mechanical properties. Objective - the objective of this research is to study the mechanism and deposition parameters of CNTD for fine-grained high-strength silicon carbides. How work contributes - silicon carbide and silicon nitride filaments, films and monolithic shapes are needed for rocket nozzles, turbine components, and radome applications. Silicon carbide was selected for the initial studies in order to utilize the extensive experience in conventional vapor deposition of SiC.

The optimum deposition parameters for CNTD will be established to produce fine-grain, high-strength SiC. Microstructure and mechanical testing data will be used in an iterative development cycle for optimizing the process.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0027, DETECTION OF MATRIX STRESSES IN GRAPHITE-EPOXY COMPOSITES

P.K. PREDECKI, Univ. of Denver, School of Engineering, *Denver, Colorado* 80210 (DF048180; AF-AFOSR-3284-77)

AF function - the function of nondestructive evaluation (NDE) in the Air Force is to save lives and resources through timely examination of aircraft and engine components to assure their continued safe operation. Deficiency - many inspection techniques have been developed for metals; however, despite the increasing use of polymer composites, there has not been an adequate development of NDE techniques for these materials. Objective - the objective of this work unit is to conduct research on the detection of matrix stresses in graphite-epoxy composites by NDE techniques. How work contributes - matrix stresses are indicative of the soundness of the composite and indicate degradation such as debonding, fiber breakage, and humidity infiltration.

A new application of X-ray stress analysis for detecting residual and applied stresses in the matrix of graphite-epoxy composites will be investigated. The method makes use of small amounts (less than 20 wt percent) of crystalline filler placed in the matrix of any desired ply or plies during the fabrication process.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0028, FRACTURE MECHANICS RESEARCH INVOLVING MINORITY STUDENTS
D.L. JONES, George Washington University, School of Engin. & Appl. Sci., *Washington, District of Columbia* 20037 (DN790019; N00019-77-C-0160)

Program to obtain an improved understanding of the effects of cyclic loading on the fracture toughness and strength of aircraft structural materials.

Study the relationship between the cyclic load-displacement record and the number of load cycles for several materials, including 7050 Al and Ti6Al-4V GFC will examined at higher cyclic parameters.

ADDENDA: Supporting agency address is: Naval Air Systems Command Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense, Navy

3.0029, FUNDAMENTAL STUDY - ELECTROMAGNETIC PROPERTIES OF ADVANCED COMPOSITE MATERIAL
B. STRAIT, Syracuse University, School of Engineering, *Syracuse, New York* 13210 (DF737220; F30602-75-C-0121)

The objective of this effort is to have a better understanding of the fundamental mechanisms controlling the electromagnetic properties of advanced composite materials with the ultimate aim of being able to tailor these properties to fit the needs of the mission without an accompanying change in the mechanical properties and density.

This information will be obtained through a subcontract with University of Notre Dame supported by an in-house effort. Technically, this will involve an investigation of the conduction mechanism in the components of composite materials, the interaction of these mechanism in the finished composite, and an examination of ways in which the properties change or can be changed (e.g., by impurities, doping).

ADDENDA: Supporting agency address is: Rome Air Development Center RBC, Griffiss AFB, N Y 13440

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0030, EFFECT OF BONDING CHARACTERISTICS ON METAL MATRIX COMPOSITE PROPERTIES
R.G. CARLSON, General Electric Company, *Cincinnati, Ohio* 45215 (DF047990; F49620-77-C-0067)

AF function - Air Force propulsion systems of the future are expected to contain metal matrix composites because of their attractive mechanical properties at substantially reduced weight. Opportunity -however, a better technical understanding is required for design and application of this class of materials. In addition, this understanding is anticipated to provide for improved impact-resistant materials for fan and compressor blades, and to allow for lower cost processing and fabrication of metal matrix composites. Objective - this research will develop an understanding of the metal matrix composites to effect a balanced increased in mechanical properties, placing specific emphasis on increased impact resistance. How work contributes - this technology can then be translated into composite systems in general, including resin matrix composites, and lead to more extensive application of composite materials to aircraft propulsion systems.

This program is directed toward understanding the basic bonding mechanisms of metal matrix composites, specifically between boron filaments and an aluminum matrix. The effort consists of three tasks -(1) surface preparation and characterization of single sandwich panels incorporating both aluminum and boron surface treatments, (2) upon extraction of correlative data, larger 8-ply panels will be selected and fabricated, and scrutinized by nondestructive evaluation, (3) the larger panels will be sectioned, and selected mechanical and physical properties will be evaluated in order to ascertain generic coupling/property behavior.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0031, CERAMIC TRIBOLOGY - SILICON NITRIDE
H. DALAL, S K F Industries Incorporated, *Norristown, Pennsylvania* 19406 (DN590201; N00019-76-C-0684)

To determine parameters such as surface distress, lubrication requirements, friction and wear behavior, etc., needed for the design of silicon nitride elements as future aircraft turbine engine bearings.

This phase aims to investigate basic powder processing technology for the manufacture of silicon nitride ball blanks and to evaluate nondestructive testing methods for defects in such materials.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense, Navy

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, PSEUDONOISE TEST TECHNIQUE FOR COMMUNICATIONS CHANNEL EVALUATION
G.D. WEATHERS, Alabama Agric. & Mech. Univ., School of Technology, *Normal, Alabama* 35762 (NAS 9-14770)

The effort includes a detailed study of the application of rms distortion testing using pseudonoise to communications channels where performance is traditionally based to some extent upon subjective factors. These channels include television and voice communications. The results of this study will be applied to the development of communication system testing techniques which will extend the usefulness of a pseudonoise test-set.

The project also includes a design study of alternate methods for non-real-time testing of data handling systems that include a record-playback process, and construction of breadboards to demonstrate the most promising techniques.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0002, ATMOSPHERIC EFFECTS ON COHERENT LASER SYSTEMS
S.S. MURTY, Alabama Agric. & Mech. Univ., School of Technology, *Normal, Alabama* 35762 (NSG 8037)

The objective of the proposed research is to continue investigations into the effects of the atmosphere on the performance of the CO2 Laser Doppler Systems. In particular, the effects of atmospheric turbulence, particulate matter and molecular gases on the performance of the heterodyne system will be investigated and tied with the experimental program. The research accomplished so far on this Grant is the following: (a) Calculation of the effects of turbulence and attenuation over a 20 km horizontal path during a round trip as a function of attitude. These results are published in the report NASA TM X-73354, 1976; (b) Study of the mutual coherence function valid for conditions of saturation of irradiance fluctuations using the radiative transport approach; (c) Calculation of the effects of aerosols on the Laser Doppler System and the ground range of the system; (d) Calculation of the atmospheric molecular absorption at 10.6 microns as a function of temperature and humidity.

Current plans are to continue the theoretical study of the effects of atmospheric turbulence in the region of saturation of irradiance fluctuations.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0003, MEASUREMENT OF TOTAL ELECTRON CONTENT BY FARADAY ROTATION AND GROUP DELAY METHODS
M.P. PAUL, Alcorn State University, Undergraduate School, *Lorman, Mississippi* 39096 (NGR 25-012-001)

Measurement of total electron content via Faraday rotation and groupsdelay techniques has proved to be a very versatile method of exploring the ionosphere and the overlying plasmasphere, because these methods continue to yield information about the media when other radio techniques become inoperative especially during the periods of excessive geomagnetic disturbances.

These techniques are being used for exploring the ionosphere/protonosphere over the Alcorn State University campus where a field station has been established and in operation since July, 1974. Two polarimeters are measuring the Faraday rotation of 137.35 MHz radiation of ATS-1 and ATS-3. These data are being analyzed to obtain the Faraday content. The results thus obtained are consistent with those for a midlatitude station.

These observing facilities have been expanded by the addition of the receiving system for the Radio Beacon Experiment of ATS-6. The coherently radiated 140 and 360 MHz radio transmissions are continuously recorded to measure the Faraday rotation and group delay between them. Further analyses of these data yield Faraday and total electron contents and thereby the protonospheric content.

Investigation is underway to study the temporal variation of these parameters especially during the periods of geomagnetic storms, solar and other transient phenomena.

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4.0004, DEVELOPMENT OF A DIRECT CONTACT HEAT EXCHANGER FOR APPLICATION IN POWER GENERATION UTILIZING GEOTHERMAL BRINES

R. MANVI, Calif. State Univ. & Colleges, School of Engineering, *Los Angeles*, *California* (NSG 7229)

The objective of this study is the development of a direct contact heat exchanger concept for application in power generation utilizing geothermal brines. The concept involves the formation of liquid sheets and bells as heat transfer surfaces by impinging fluid jets. Cold experiments with mineral oil and water have been completed to understand and study fluid dynamics of immiscible colliding jets. Plans are underway to design heat transfer experiments in which hot water as the primary fluid and refrigerant 113 as the secondary fluid impinge at various angles.

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4.0005, DIFFERENTIAL SCANNING CALORIMETRY OF COAL

P.I. GOLD, Calif. State Univ. & Colleges, School of Engineering, *Los Angeles*, *California* (NSG 7263)

The purpose of this study is to continue the program of experimental thermal analysis of coal to provide quantitative data suitable for the development of thermal design criteria for high-pressure coal feeding processes.

Differential scanning calorimetry studies performed during the first year of this project demonstrated the occurrence of exothermic transitions associated with the production of volatile matter in or near the plastic region. The objective of the next phase of the program is to develop a more quantitative understanding of this behavior by including both thermogravimetric analysis and evolved gas analysis by gas-liquid chromatography. These techniques will also be used to study degradation of coal under various and strange conditions. Finally, criteria developed during last year will be used to design and test experimental methods for the measurement of thermal conductivity of coal at high pressures.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0006, SIMULATION OF HOT SURFACE IGNITION OF FLAMMABLE LIQUIDS (ABBREV)

D.J. MYRONUK, Calif. State Univ. & Colleges, School of Engineering, *San Jose*, *California* 95114 (NSG 2165)

An anticipated goal of this proposed program is to assess an optimum effectiveness as well as limitations of extinguishant agents in nacelle-type fire knock-down and continued fire suppression. Applied singly or in combinations, the agent candidates will be compared to baseline performance data for modified potassium bicarbonate (PKX) and chlorobromodifluoromethane (Halon 1211). A laboratory-sized nacelle-type fire simulator has been fabricated at the Ames Research Center which can provide a heated surface (400 to 1000 degrees Celsius) capable of igniting flammable liquids (JP4, JP5, JP6, lubricating oil, hydraulic fluids) in a dynamic condition with cool or pre-heated air flowing at speeds between 0 and 60 meters per second.

Flammability characteristics and limits for dynamic ignition of specific liquids and vapors can also be measured in the fire simulator.

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4.0007, ANALYSIS AND INVESTIGATION OF AEROSPACE NICKEL-CADMIUM BATTERIES

P.P. MCDERMOTT, Coppin State College, Undergraduate School, *Baltimore*, *Maryland* 21216 (NSG 5051)

The objectives of this program are: 1. To staff the Electrochemical Analysis Laboratory at the Goddard Space Flight Center and to perform standard physical, chemical and electrochemical tests on secondary cells (primarily Nickel-Cadmium) and cell components. 2. To train minority college students in the tools of scientific analysis by having them perform research under this grant both at Coppin State College and at the Goddard Space Center. 3. To do basic research into the fundamental mechanisms associated with cell failure in order to improve the life and efficiency of the Nickel- Cadmium system. 4. To provide technical assistance in evaluating data from an extensive NASA-supported accelerated test program of Nickel-Cadmium cells being performed at the Naval Weapons Support Center, Crane, Indiana.

A full-time research associate performs battery testing at the Electrochemistry Laboratory at Goddard and trains students in these techniques during the summer months and in January prior to the initiation of the Spring Semester.

The principal investigator has reported the results of his work on positive plate deterioration, cadmium migration, and the analysis of accelerated test program data, in several NASA documents, at the annual Battery Workshop at Goddard, and at the Fall meeting of the Electrochemical Society.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0008, INVESTIGATION OF THE DYNAMIC RANGE PROBLEM AND PROVIDING HARDWARE SUPPORT FOR THE AIRBORNE OCEANOGRAPHIC LIDAR SYSTEM

A.K. TREHAN, Hampton Institute, Graduate School, *Hampton*, *Virginia* 23368 (NGR 47-020-006)

Most of the research work has been focussed to improve the dynamic range of the AOL System. Logarithmic amplifiers have been investigated and can improve the dynamic range of the system to some extent. It has also been found that reducing the gain of the sample and hold gates also improves the dynamic range of the system.

At present, work is in progress for establishing procedures for retrieving information out of the digital data scan of the system. Studies are underway to determine the best calibration system for the AOL System.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0009, INVESTIGATION OF MICROPROCESSORS AS MASS STORAGE CONTROLLERS FOR FLIGHT APPLICATIONS

A.K. TREHAN, Hampton Institute, Graduate School, *Hampton*, *Virginia* 23368 (NSG 1294)

During the first phase of this study a microprocessor controlled camera system was designed. The special camera used in the system views the real world as a series of small points which are referenced by a coordinate system. The digital information about each point is later processed by a computer system and a composite picture is retrieved from the data by using a conventional camera. The microprocessor system which has been designed controls the position of the camera, and collects the imagery data for the camera. It also performs pre-processing of the data and stores the processed data on cassette tapes.

The second phase will study the high-speed processor for use with the camera system. The processor will be used in real time to analyze and reduce the amount of received data to a format easily usable by the various governmental agencies, educational and private institutions who need such data.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0010, A PROPOSAL TO INVESTIGATE A SYSTEMS APPROACH TO THEORETICAL FLUID MECHANICS

J.C. ANYIWO, Hampton Institute, Graduate School, *Hampton, Virginia* 23368 (NSG 1456)

The objective is to establish a simple, workable and useful systems approach to theoretical fluid mechanics, free from the inconsistencies and incompleteness of existing methods of general fluid flow analysis.

The proposed approach is: (a) To undertake a thorough and systematic theoretical investigation of the general fluid flow problem from the point of view of general system theory; (b) To establish, by this general system mentation, the significant groups of basic methods of theoretical fluid mechanics, documenting the essential methodology of each such group; (c) To identify the 'fundamental' problems, if any, limiting each group of basic methods from a complete practicable mathematical description of the general fluid flow system; (d) To solve these fundamental problems thus identified, and thereby to provide a group of practicable mathematical methods for real fluid flow analyses; and (e) To test the validity and accuracy of each of the methods thus elicited, vis-a-vis their descriptions of experimentally documented real flow situations.

Work on the project will commence October 1, 1977 and run through to September 30, 1978, proceeding part time during the regular academic year and full time during the summer months. Close contact will be maintained with Dr. D. Bushnell's group at NASA Langley Research Center through whom NASA's computational facilities will be accessed for the work.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0011, THEORETICAL EVALUATION OF LINEAR KALMAN FILTERING TECHNIQUES

A.K. CHOUDHURY, Howard University, School of Engineering, *Washington, District of Columbia* 20001 (NSG 9010)

Theoretical Evaluation of Linear Kalman Filtering Techniques for Advanced Mission State Determination.

Most practical filtering problems involve delay in the state variables due to the time taken in the transmission of signals. The delayed state space equation is of the form: XK plus 1 equals AXK plus B XK-l plus C UK; YK equals D XK plus VK where l greater than or equal to 1 is the delay, UK, VK are white Gaussian noises, and the matrices A,D,C,D are of appropriate dimensions. In case of delayed state space model degeneracy occurs and plays an important role.

The system XK plus 1 equals A XK plus B XK-l; YK equals D XK is said to be degenerate if YK is identical to O, K more than or equal to n, where n is a positive integer. Constructions of degenerate systems, i.e., given D,A, l, to find B such that YK is identical to O, K more than or equal to n is an important problem. Constructions of degenerate problems containing all possible free parameters are being investigated.

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4.0012, AERODYNAMICS FOR SOUNDING ROCKETS

D.N. FAN, Howard University, School of Engineering, *Washington, District of Columbia* 20001 (NAS 5-24242)

OBJECTIVES: The primary objective of the contract work is to augment and update the computer program for the prediction of aerodynamic derivatives of sounding rockets, which is currently in use at the NASA Goddard Space Flight Center (GSFC).

APPROACH: A thorough study of the existing computer program will be made by the contractor's project team to familiarize themselves with the scope and capabilities of the program. In the meantime the team will review the coding and the application of the second-order shock-expansion theory therein.

A comprehensive literature search and review on body-fin and slender-body aerodynamics will be conducted to identify (a) significant new theoretical and experimental results for possible incorporation into the aerodynamic-derivative program and (b) critical areas in the aerodynamics of sounding rockets where additional research is particularly needed.

CURRENT PLANS AND/OR PROGRESS: Subsonic fin aerodynamics with compressibility corrections and supersonic second-order shock-expansion theory applied to convex slender-body shapes were two tasks chosen to initiate the study and they are being pursued. These are to be followed by the study of body-fin and fin-fin interference effects and the application of the shock-expansion theory to concave contours and shoulders.

Computer literature search using the NTIS system was completed. A similar search using RECON at GSFC is planned.

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4.0013, GRADUATE RESEARCH PROGRAM IN AERO-SPACE STRUCTURES

G.M. SABNIS, Howard University, School of Engineering, *Washington, District of Columbia* 20001 (MSG 1320)

Grant provides funding for a program of research by teams of graduate students and faculty, with assistance and advice from NASA personnel. Students pursue the masters degree with a major in Aero-Space Structures.

The present research effort is in the field of large space structure technology. This field aims to provide, by the late 1970's, the technology to display and/or construct large, plate form-like structures in space for a variety of purposes.

The project being conducted under this grant presently is an experimental study of foldable tubes for use as truss or frame members in large space structures. The objectives are: (1) to relate parameters associated with the collapse behavior, i.e., geometry and material properties, (2) to study the manner in which folding takes place for various tube shapes and lengths, and (3) to ultimately set design guidelines for optimizing the design of such tubes.

The project consists of design and fabrication of specimens, design and construction of a test rig, setting up and conducting experiments and analyzing data. Two graduate students are scheduled to join the two faculty members and technicians who have begun the work.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0014, THE DEVELOPMENT OF AN INFANT WEIGHING SCHEME

E.M. DELOATCH, Howard University, School of Engineering, *Washington, District of Columbia* 20001 (NSG 5081)

The objective of this study is to determine the feasibility of developing a self-contained electronic weighing system for use in infant intensive care units. Premature infants must be confined in isolated environments where the critical parameters of temperature, humidity, oxygen tension and infections sources are carefully controlled. To monitor body weight of the infant, it is desirable to have available a system and technique which does not violate the controlled environment. The research undertaken here is intended to meet that objective.

Currently two attempts at recording weight through transducer systems placed beneath the infant's resting platform, in a

baby incubator, are being investigated. Major problems of repeatability and electronic measurement realiability remain to be solved. A breakthrough in these areas could lead to improving mortality statistics among premature and otherwise sick infants.

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4.0015, CONTINUUM MODELING OF LARGE AREA SPACE STRUCTURES

T.H. BROOME, Howard University, School of Engineering, *Washington, District of Columbia* 20001 (NSG 1130)

Large area space structures, such as solar arrays and antennas, will be vast frameworks which may extend several kilometers across a plane, and built up from many thousands of rod-like parts. Mechanical analyses of such structures using existing finite-element methods will be impractical owing to the many degrees of freedom involved which lead to severe matrix computer storage and CPU difficulties. The objective of this project is to develop a method for modeling such structures as continua, thereby reducing the computer difficulties. The approach models the framework as an isotropic continuum whose displacements at certain discrete points, called nodes, are identical to the nodal displacements of the framework, but whose loading is consequently different. This difference in loading is approximated by an equivalent body force field so that the governing equations for an isotropic continuum can be used. Satisfactory results have been obtained for structures modeled as plane stress plates subjected to both mechanical and thermal loadings. Extensions will be made to account for joint rotations.

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4.0016, RESEARCH OF MICROWAVE SEMICONDUCTOR DEVICES

E.M. DELOATCH, Howard University, School of Engineering, *Washington, District of Columbia* 20001 (NSG 5158-A)

The objective of this project is to achieve improved performance in microwave semiconductor devices. The current research undertaken here is both experimental and theoretical. In the experimental research effort, liquid phase epitaxy is being used to grow GaAs semi-insulating substrates and p-n junctions. Growth parameters are being studied with a view to optimize them. Impurity profile studies are being carried out on materials grown using depletion capacitance measurements. In addition to growing materials and characterizing them, studies are being carried out on the large signal characterization of GaAs IMPATTs and on microwave measurement techniques for FET's and MESFET. Modeling studies for microwave semiconductor devices are also being conducted.

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4.0017, LARGE-SIGNAL MEASUREMENTS OF GAAS IMPATT DIODES

R. CHOWDHARY, Howard University, School of Engineering, *Washington, District of Columbia* 20001 (NSG 5158-C)

The objective of this project is to study the large-signal behavior of GaAs IMPATT diodes. In particular, effects of depletion width modulation and the velocity-field characteristics for electrons on the device performance will be investigated. Tradeoffs of using double-drift vs. single-drift Read design will be identified.

The ongoing studies are preliminary to achieving the final goal. First, an experimental set-up for the study of the d-c and small-signal characteristics of the IMPATT diodes is developed in the lab. With the addition of some more equipment, this capability will be extended to study the large-signal characteristics.

The present set-up was already tested and the small-signal results were obtained on the lo-hi-lo Schottky-barrier GaAs IMPATT diodes. Next, computer programs were written to simulate the practical devices. So far, only the d-c and small-signal results have been obtained. The large-signal program has to be modified to obtain meaningful results.

In the final analysis, the experimental results will be compared with the computer-simulated results and conclusions will be drawn from such a comparison.

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4.0018, MICROWAVE SEMICONDUCTOR DEVICES RESEARCH

Y. WANG, Howard University, School of Engineering, *Washington, District of Columbia* 20001 (NSG 5158-D)

Characterization of short-gate FET by analytic solution of velocity over-shoot. The research is anticipated to be completed by Feb., 1979. It is found that the velocity over-shoot in GaAs FET needs to be modified from that obtained by Maloney and Frey and that the velocity over-shoot depends on the bias conditions of the FET. An informal talk on this problem had been given at Cornell Biennial Conference, Aug., 1977.

Multi-cell GaAs FET modeling is in progress. It will be completed by the end of 1978. In this work, comparisons of performances between the single-cell and multi-cell structures will be obtained. Previously the output power, gain, stability factor, and the impedance level all have been compared. Under current investigation are the noise figures for the two structures.

Analytic solution of concentration gradient and the effect of substrate in FET will be planned as a research project conducted in 1978.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0019, THE DYNAMICS AND CONTROL OF LARGE FLEXIBLE SPACE STRUCTURES

P.M. BAINUM, Howard University, School of Engineering, *Washington, District of Columbia* 20001 (NSG 1414)

It is proposed to investigate attitude control techniques for the pointing and stabilization of very large, inherently flexible spacecraft systems. The attitude dynamics and control of a long, homogeneous flexible beam whose center of mass is assumed to follow a circular orbit are currently being analyzed. In this initial phase, first-order effects of gravity-gradient are included, whereas external perturbations and related orbital station keeping maneuvers are ignored. To this date, three mathematical models which describe the system rotations and deflections within the orbital plan have been developed - one model, which treats the beam as a number of discretized mass particles connected by massless links, and two continuum-type models. Once the natural (uncontrolled) dynamics of this system have been simulated, it is then planned to consider the effect of the control devices. The concept of distributed model control, which provides a means for controlling a particular system made independently of all other modes, will be examined, along with types of control laws. The effect of varying the number of modes in our model as well as the number and location of control devices will be examined, analytically, where possible, and numerically for general cases.

As time permits, three-dimensional mathematical models of beams and/or a circular homogeneous thin disk will also be treated, following the approach described above for the two-dimensional beam.

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4.0020, MICROWAVE SEMICONDUCTOR DEVICE RESEARCH

T.N. BHAR, Howard University, School of Engineering, *Washington, District of Columbia* 20001 (NSG 5158-B)

GaAs Material Growth and Device Fabrication: The following are the tasks under this grant: 1. Equipping of the Solid State Electronics Laboratory will continue in order to develop the full

capability to perform 2,3 and 4 below. 2. n-type LPE layers will be given on semi-insulating GaAs substrate. 3. Impurity profile studies will be carried out on materials grown using depletion capacitance techniques. 4. Transport measurements will be performed to study the type conversion during arresting of LPE layers.

PROGRESS: Renovation and equipping of the Growth and Characterization Laboratories are essentially completed and a number of epitaxial layers have been grown with LPE reactors. Impurity profile studies for all the layers have been carried out.

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4.0021, NUMERICAL ANALYSIS OF FLOW AND PRESSURE FIELDS ACROSS A TWO-DIMENSIONAL RECTANGULAR GROOVE

C. CHU, Jackson State University, School of Liberal Arts, *Jackson, Mississippi* 39217 (NSG 3004)

A two-dimensional flow across a rectangular groove is investigated by numerical methods. Viscous, incompressible, Newtonian and laminar flow is assumed. The velocity and pressure distributions under different flow configurations and Reynolds numbers are to be investigated.

The flow field is divided into small square meshes. Then the partial differential equations of motion with nondimensional stream function and vorticity as dependent variables are converted to a set of finite-difference equations at each mesh point inside the flow field. The large set of linear algebraic equations are solved by iterative method with the introduction of relaxation factors. The velocity components at each mesh point are calculated from the definition of stream function. Iterative method is applied again in the computation of the pressure distribution.

The computer program for computing stream function and vorticity at each mesh point in the flow field has been completed. The program for computation of pressure distribution by iterative method is in debugging stage and expected to be completed at the end of October 1977. The necessary data collection should be completed in February 1978. The remaining funding period will be spent to analyze the result and draw conclusion of the investigation.

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4.0022, INVESTIGATION OF LASER-INDUCED PARAMETRIC INTERACTIONS IN OPTICAL WAVEGUIDES AND FIBERS

C. YU, North Carolina A & T St. Univ., School of Engineering, *Greensboro, North Carolina* 27411 (NSG 1346)

The objective and approach are: 1. To extend the present nonlinear analysis of lossless and steady-state plane waves. This will include multiple wave scattering due to three-wave processes; loss threshold for parametric interaction; and self focusing effects. 2. Investigation of the mechanism of nonlinear laser interaction using phonons as models. This will include the isolation of the various interaction configurations; verification of the experimental dependence of the fraction of forward transmitted energy after anomalous reflection of the incident laser power using optical fiber waveguides; establishing more consistent results of the effect of crystal orientation; transient effects of subnanosecond laser pulses. 3. Studies of laser-induced damage in laser materials. Currently we are working on further verification of the loss mechanism and scattering process in optical waveguides. Also we are requesting a three-month extension without cost.

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4.0023, EFFECT OF TEMPERATURE ON COMPOSITE SANDWICH STRUCTURES SUBJECTED TO LOW-VELOCITY IMPACT

A.V. SHARMA, North Carolina A & T St. Univ., School of Engineering, *Greensboro, North Carolina* 27411 (NSG 1296)

The objective of this phase of research work was to determine the effect of projectile impact at low velocities on the strength carrying ability of composite sandwich beams at high (366 kappa) and low (223 kappa) temperatures. The specimens tested were of graphite/epoxy (T 300/5208 with 130 kg/m3 Al core, (90, plus or minus 45, 0)5) and hybrid (T 300/G5208 with 48 kg/m3 Nomex core, (0K, 90G, 0G)S) system. Using a four-point beam-bending apparatus, the specimens were tested in both compression and tension at the above temperatures. Impact energy levels were confined up to the range of 1.4 to 4 joules.

The experimental results led to the following observations: a) Failure threshold can be established as a function of impact energy level. b) The ultimate strength (sigma mu) of G/E specimens at high temperature (HT), tension/compression, was 8 per cent lower as compared to room temperature (RT) values. c) The G/E specimens at HT, compression, were able to withstand higher pre-impact loads as compared to those tested at ST, tension. The residual strength was also found to be higher. d) The tensile sigma mu of G/E specimens remained same in HT and low temperature (LT) tests. (e) The compressive sigma mu in LT tests was found to be slightly higher than in HT tests. f) The maximum strain values in HT/LT tests were in the range of 0.9 percent to 1 per cent.

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4.0024, MATERIAL GROWTH AND CHARACTERIZATION DIRECTED TOWARD IMPROVING III-V HETEROJUNCTION SOLAR CELLS

W.E. ALEXANDER, North Carolina A & T St. Univ., School of Engineering, *Greensboro, North Carolina* 27411 (NSG 1390)

This research program is apart of the Solid-State Electronic Development Program at A & T State University. The overall objective of this program is to achieve an ongoing capability with facilities for material growth and characterization device fabrication and testing emphasizing III-V semiconductor compounds and alloys grown by liquid-phase epitaxy and applied to solar cells and other opto-electronic devices.

The liquid-phase epitaxial growth capability has been established and material growth has been started. Most of the experimental work has been concentrated on preparing the growth materials and substrates to achieve reproducible liquid-phase epitaxial layers. Procedures for handling the materials have evolved which minimize contamination of the system components, melts and substrates. The quality and consistency of the results have improved significantly.

Experimental results to date indicate that system modifications in boat design and furnace design are very desirable. These modifications are being implemented. Future plans call for the growth of GaAlAs with varied mole fractions of aluminum and characterizing these materials with regard to application to solar cells.

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4.0025, OPTICALLY PUMPED SUBMILLIMETER WAVES AND APPLICATIONS

J.M. DUTTA, North Carolina Central Univ., Graduate School, *Durham, North Carolina* 27707 (NSG 5120)

An initial objective of this project is the construction and testing of a well-designed far-infrared laser with improved power efficiency. In this respect, the design criteria suggested by Koepf and McAvoy ('Design Criteria for FIR Waveguide Laser Cavities,' IEEE Journal of Quantum Electronics, QE-13, p. 418, June 1977) have been utilized.

Subsequently a scattering chamber will be designed and constructed for the purpose of studying the scattering of far-infrared radiation by water vapor and fogs of various densities.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0026, DETERMINATION OF PARTICLE SIZE USING MEASUREMENTS OF SCATTER

R.L. SCOTT, Southern Univ. A & M College, School of Engineering, *Baton Rouge, Louisiana* 70813 (NSG 8029)

The objective of this grant was to determine if scatter measurements from glass spheres placed on a mirror in the size range 5 to 50 microns could be correlated with size. The spheres were illuminated with a laser whose wavelength was 0.62 microns. A Gonioreflectometer was used to vary the detector between the normal to the mirror and 85 degrees from the normal and in the plane containing the normal to the mirror and the incident laser light. The azimuth of the detector with respect to the source was 180 degrees. The light detector was driven by a step motor. The scatter was dark and bright lines. They appeared as minima and maxima on the output recorder. As the size of the beads increased the number of maxima increased.

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4.0027, STATE VECTOR UPDATE FILTER FOR AUTOLAND PORTION OF THE SHUTTLE LANDING

G.S. GREWAL, Southern Univ. A & M College, School of Engineering, *Baton Rouge, Louisiana* 70813 (NSG 9030)

This proposal is for the continuation of the research conducted by the principal investigator under NASA grant NSG-9030.

The autoland portion of the shuttle landing, which starts at approximately 12,000 to 2,000 feet altitude, requires a high-rate state vector update. The processing of the external navigation aid data at a rate greater than 2/sec. would require a replacement of the sophisticated Kalman filter with a faster filter like the complementary filter used by Sperry on CV990 autoland project, or a modified suboptimal version of the general Kalman filter.

The state vector of the general Kalman filter, as used in the shuttle, has twelve components; three for the position, three for the velocity, three for the IMU platform alignment errors, and three for the measurement biases. In the land phase the dimension of the state vector is reduced to six; three for the position and three for the velocity of the shuttle. Experience has shown that the switch-over from the Kalman to the complementary filter is not very successful, especially as far as the velocity component of the state vector is concerned. The author has derived the bounds on the error between the Kalman and the complementary filters assuming no IMU misalignment and measure biases, but the errors from the experimental results exceed the analytic bounds. This indicates that the IMU misalignment and the measurement biases cannot be ignored in the complementary filter, i.e., the complementary filter should be expanded from six to twelve states. This would entail extra computation time for the complementary filter, thus diluting its value.

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4.0028, COMPARISON OF EXPERIMENTAL DATA WITH MATHEMATICAL MODELS FOR COMBUSTION CHAMBER MIXING

J.C. OHARA, Texas A & I University, School of Engineering, *Kingsville, Texas* 78363 (NSG 3112)

The objective of this work is to analyze experimental turbulent mixing data obtained from tests on a liquid rocket combustion chamber. These tests which were conducted under a previous grant provided values for intensity of turbulence and Lagrangian correlation coefficient as a function of longitudinal position for a propellant combination of GH2-GOX.

The analysis is to consist of two parts. First the accuracy of the experimental data is to be considered and an attempt made to explain certain discrepancies noted within runs and between runs. After the accuracy of the data is established a comparison is to be made between the experimental data and existing turbulent mixing theories.

The first part of this work is nearing completion; however, it is doubtful if any significant progress can be made on the second part under the present grant.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0029, INVESTIGATION OF ELECTRICAL BREAKDOWN CHARACTERISTICS AND STABILITY OF INSULATING MATERIALS USED ON SOLAR CELLS

C.V. DORESWAMY, Tuskegee Institute, School of Engineering, *Tuskegee Institute, Alabama* 36088 (NSG 8038)

Past and current studies have indicated that the interaction of space plasma with the solar cells mounted on the surfaces of the spacecraft may cause serious damage to solar cells and their insulation. Investigations are currently being conducted on the effect of simultaneous effects of very high electrical voltages and thermal stresses on typical insulating materials used on solar cells. The insulating materials will also be subjected to effect electrons and positive ions. The changes in the dielectric properties in the insulating material and the degradation will be measured. The quantities identified for accurate measurement are: the dissipation factor, the dielectric constant and the surface resistivity of the insulating materials.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0030, ANALYTICAL INVESTIGATION OF THE HEAT-PIPE RADIATOR AS A SPACECRAFT HEAT REJECTION SYSTEM

J.P. SELLERS, Tuskegee Institute, School of Engineering, *Tuskegee Institute, Alabama* 36088 (NAS 9-13844)

As a result of NASA-sponsored feasibility and prototype heat-pipe radiator testing, valuable experimental data are being accumulated. In this study the analysis, interpretation and documentation of these data will be continued. Computer models, either those written previously for NASA, or new ones when needed, will be used to complete the analysis.

Because of the current interest in the fluid header concept and its demonstrated high performance, particular emphasis will be placed upon analysis of data from the JSC prototype panel vacuum tests. All single-panel data obtained to date have been analyzed and the results reported; 3-panel results will be obtained during the time frame of the present contract.

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4.0031, INERTIAL REFERENCE TECHNOLOGY RESEARCH EXPERIMENTS

R. JENKINS, Univ. of Southern Colorado, School of Applied Sci. & Eng., *Pueblo, Colorado* 81001 (NSG 2048)

RESEARCH OBJECTIVES: The primary objective of the proposed research effort is to conduct research in inertial sensor and computer fault tolerance technology which will provide a sound basis for future integrated navigation and flight control system decision-making. The secondary goals are to: (a) Provide the potential for reliable inertial sensor redundancy management. (b) Extend the redundancy management concept to include multiple computer fault tolerance.

RESEARCH APPROACH: Research will be conducted to study inertial sensing redundancy management algorithms using three different sensor configurations (tetrad, pentad and hexad) to determine which configuration has the greatest potential in terms of VTOL cost, reliability and performance criteria.

Three different levels of experimentation will be used: computer simulation, laboratory simulation with real sensors and sensor package operation in a VTOL avionics environment. Computer simulation will involve algorithm development on a large-scale computer using the most applicable high-level language. Laboratory simulation will be performed with real inertial sensors (gyros and accelerometers) arranged in the three candidate configurations and subjected to typical and extreme attitude profiles. Each configuration will be studied to determine the best relative position arrangement of the sensors. Each sensor package will be operated in a VTOL environment to determine the reaction of the

candidate redundancy management algorithms to the variables associated with vibration, temperature change, humidity, power source transients, etc.

The redundancy management concept will be extended to include multiple computer fault tolerance. 'Purging' logic will be developed to enable detection and isolation of a faulted computer. Microprocessors will be used as basis for the candidate multiple computer configurations. Inertial redundancy management algorithms will be modified for use with computer fault isolation. Initially simulations will be performed on a large-scale computer using a high-level language. Based on the results of these simulations the most successful algorithms will be implemented in a VTOL navigation and flight control multiple computer configuration and studied to determine which has the greatest potential in terms of cost, reliability and performance criteria.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0032, NONDESTRUCTIVE VERIFICATION OF INSULATION INTEGRITY AT ATMOSPHERIC PRESSURE AND IN VACUUM

R.S. BEVER, Univ. of The Dist. of Columbia, Undergraduate School, *Washington, District of Columbia* 20009 (NGR 09-053-003)

Partial Discharge (Corona) measurement is a sensitive technique for examining the integrity of electrical insulation systems, under High Voltage (H.V.) stress. It is being studied for Direct Voltage conditions (D.C.) as opposed to A.C. In the D.C. case the corona inception, repetition rate and charge content of pulses are controlled by the relative conductivities of the bulk dielectric and of the corona-causing void or flaw. These conductivities in turn are dependent on polarization and dielectric absorption effects. Two sets of instrumentation are in use: a) a system to 5000 volts D.C. with RC input to a FET first stage preamplifier, sensitivity of one hundredth picocoulomb; b) a Biddle Co. system to 40,000 volts D.C. with LCR power separation filter and read-out on a multichannel analyzer, sensitivity to one picocoulomb. The basic experiments are carried out on bubbles of controlled size and placement in a plant-parallel slab of dielectric. Applied work has been done on connectors and portions of the high-voltage power supplies for the HEAO-A satellite, and on facsimiles of the insulation system of the SEC Vidicon tubes for the IUE satellite. Presently, rejection criteria for H.V. ceramic disc capacitors are being sought, based on their partial discharge histograms.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0033, OPTICAL PROCESSING STUDY

F. HPRRIGAN, Science Applications Inc., *La Jolla, California* 92037 (DF902330; F19628-77-C-0110)

AF function - surveillance, communications. Deficiency - wideband radar optical and communciations signals can not be processed to provide desirable system performance. How research contributes - optical signal processing can potentially provide enormous gains in signal processing capability if suitable devices performing the processing can be developed.

The advantages and disadvantages of optical signal processing techniques, alone or in combination with other techniques, will be explored. Technology developements necessary to carry out optical processing schemes where they offer advantages will be pointed out and promising approaches will be analyzed. Emphasis will be on real time processing in applications to wideband radar, spread spectrum communications, electrooptical surveillance and signal intelligence. Both coherent and incoherent techniques will be explored.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0034, EXPERIMENTAL MEASUREMENTS OF UNSTEADY TURBULENT MIXING PHENOMENA ASSOCIATED WITH AERONAUTICAL SYSTEMS

C.M. HO, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (DN775391; N00014-77-C-0314)

Turbulent mixing phenomena play a central role in many fluid dynamic applications ranging from the flow at the trailing edge of a wind to the flow in a chemical laser. The proposed research will examine, experimentally, the mixing between two co-flowing jets in which periodic oscillations will be introduced.

In recent years significant progress has been made in the interpretation of the nature of the turbulent mixing of two, steady, planar, co-flowing jets. The planned experimental work will extend this understanding to the unsteady case and, hopefully, will illuminate, for example, the nature of the unsteady flow at the trailing edge of an oscillating airfoil. The experiments will be conducted, initially, in water for visualization purposes, and subsequently, in air where detailed turbulence measurements will be made. The periodic disturbances will be introduced by oscillating vanes in the settling chambers upstream of the co-flowing jets.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0035, AEROELASTIC OPTIMIZATION WITH MULTIPLE CONSTRAINTS

S.C. MCINTOSH, Nielsen Engin. & Research Inc., *Mountain View, California* 94040 (DF047500; F49620-77-C-0055)

AF function - advanced flight vehicle structures of lighter weight and increased durability will be necessary to achieve future Air Force mission requirements. Deficiency - current aerospace vehicle designs do not reflect consistent consideration of disciplines influencing structural designs. Objective - objective of this research program is to investigate structural optimization techniques applicable to multiple constraint conditions representative of aerospace vehicles. How work contributes - this effort is part of a program to develop the basic capability required to achieve optimal structural design in the Air Force.

Research program will investigate the efficiency and accuracy of basic solution algorithms for minimum-weight structural designs. Primary attention will be given to math programming (MP) and optimality criteria (OC) algorithms involving flutter speed and vibrational constraints. Fixed and variable mode coordinate will be used in examining convergence to flutter speed and computational efficiency.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0036, CLOSURE RELATIONS IN FLUID MECHANICS

D. BAGANOFF, Stanford University, School of Engineering, *Palo Alto, California* 94305 (ENG75-15230)

Purpose of this research project is to apply a closure scheme for the solution of the Boltzmann equation for shock-wave structure. Particular attention will be focused on implications of the operations of straining and shifting in velocity space and the physical consequences of the continuum interpretation of these closure relations. Complete shock-wave structure computations will be carried out starting with the 13-moment equations. Direct comparisons will be made of the fluid dynamic variables with purely numerical solutions to the same shock structure problem.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0037, DYNAMICS OF LARGE SYSTEMS

T.R. KANE, Stanford University, School of Engineering, *Palo Alto, California* 94305 (ENG77-04449)

The research program will investigate the dynamics of large structural systems, such as those encountered in the study of human motion, and in problems involving the motions of flexible space vehicles and road vehicles.

The objective is to facilitate both the formulation of the governing equations and the extraction of useful information

from these equations, and to apply these general concepts to selected specific problems.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0038, COMMUNICATIONS - LOW-ENERGY PARTICLE DETECTOR

S.E. DEFOREST, Univ. of California, Graduate School, *San Diego, California* 92037 (DN775346; N00014-77-MP-0018)

Energetic charged particles in the earth's magnetosphere cause potentially damaging voltages to build up on spacecraft such as the planned Navy fleet SATCOM, and when precipitated into the ionosphere disrupt naval communications, navigation, and surveillance systems. Experimental measurements of the energies and pitch angle distribution of the charged particles are required to understand the spacecraft charging phenomenon, as well as wave particle interaction.

A particle detector to measure the energy and pitch angle distribution of proton and electron fluxes in the 1 eV to 70 KeV energy range is being designed and tested for flight on the Air Force SCATHA spacecraft with a planned launch date early in 1979. Data from this detector will be used to define the properties of the ambient plasma and to infer charging potentials prior to and during periods of spacecraft charging, and will allow for the interpretation of the charging phenomena observed.

ADDENDA: Supporting agency address is: Office of Naval Research Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0039, GEOPHYSICAL FLUID DYNAMICS

J.W. MILES, Univ. of California, School of Engineering, *San Diego, California* 92038 (OCE74-23791 A02)

This project will continue research in geophysical fluid dynamics in the La Jolla Laboratories of the Institute of Geophysics and Planetary Physics. The principal topics will be: (2) theoretical studies of tides and planetary waves in the terrestrial and other (especially Jovian) planetary atmospheres, (b) theoretical studies of internal tides in the ocean, (c) theoretical studies of equatorial currents and waves, (d) theoretical, and possibly experimental, studies of harbor resonance, and (e) experimental studies of wake collapse in rotating fluids.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

4.0040, NONEQUILIBRIUM PROPERTIES OF EXHAUST PLUMES

M.C. BRANCH, Univ. of Colorado, Graduate School, *Boulder, Colorado* 80302 (DF045970; AF-AFOSR-3103-77)

AF function - many future tactical rockets will require smokeless propellants. Deficiency - such propellants currently do not meet performance or stability requirements. Objective - this effort will measure the spatial and size concentrations of well-characterized laboratory jets. How work contributes - analytical models of low-signature low-altitude plumes will be compared with this data for modification of plume prediction codes.

Measurements will be taken of the major stable species, temperature, particulates and electron concentrations. The measurements will be taken at the exit plane of the nozzle and will be spatially resolved throughout the exhaust plume. The exhaust plume will be studied by high-speed cinematography. Stable species will be measured with a reporting gas chromatograph and water-cooled sampling probe.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0041, SYSTEM-ORIENTED CODING THEORY AND TECHNIQUES

F.P. PREPARATA, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (ENG75-22621 A01)

The traditional goal of coding theory is reliable communication. It envisions a communication system in which an encoder processes the sequence of source symbols to produce a sequence of transmitted symbols which is a redundant representation of the source sequence. At the receiver, a decoder can use this redundancy to correctly estimate the source sequence even though several transmitted symbols are received in error. In recent years, this technique of introducing redundancy into a transmitted sequence has also been used for purposes other than error-control. For example, encoders have been devised such that the spectrum of the resulting signal has desirable properties such as concentrating signal power in desirable portions of the frequency band allocated for the channel. Another application, prompted by the deployment of communication satellites, is that of multiple-access communications where several users share the same channel and the basic problem is to distinguish between the messages of various users while also coping with more traditional problems of reliable communication. Here, redundancy can be used to create sufficient differences between the signaling waveforms of the various users so that the discrimination can reliably occur. The research deals with coding techniques for discriminating between users in a multiple-access system, coding for spectrum shaping and the computational complexity of encoding and decoding algorithms for block coding schemes.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0042, INITIATION, COMBUSTION AND TRANSITION TO DETONATION IN HOMOGENEOUS AND HETEROGENEOUS REACTIVE MIXTURES

R.A. STREHLOW, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DF049180; AF-AFOSR-3336-77)

AF function - advanced chemical explosive weapons, weapon delivery and defense, close-air support. Deficiency - insufficient understanding of basic chemical kinetic and gas dynamic processes associated with chemical initiation and transition to detonation in unconfined fuel-air clouds, lack of realistic guidelines for predicting detonation initiation, properties, scaling laws and blast potentials, and of data for evaluating feasibility of chemically initiated (single event) FAE III concept, and for evaluating vulnerability of aircraft components to flames, blast and detonation waves. Objective - to obtain better understanding and realistically model basic mechanisms responsible for chemical initiation and subsequent transition and propagation and attenuation of unconfined fuel-air explosions and non-ideal blast waves in reactive media. How work contributes - will provide (1) additional fundamental understanding of processes of chemical initiation of detonations, transition from deflagration to detonation and attenuation and quenching of flames, blast and detonation waves, (2) quantitative models not now available for a priori predicting properties and blast initiation requirements of unconfined fuel-air explosions, their scaling laws and blast damage potential of FAE clouds, (3) data for evaluating feasibility of chemical initiated detonation concept for application to advanced (single event - FAE III) explosive devices, guidelines for evaluating effective flame and detonation arrestors.

Initiation of detonation by non-linear finite amplitude waves will be studied using rapid response pressure gases, optical and smoke track techniques in fuels of interest to the Air Force behind the reflected shock in a preheated incipiently explosive region. Theoretical models for the initiation process will be formulated based on these results and compared with those of existing models. Concurrently the process of detonation initiation as triggered by local concentrations of reactive chemical promoters will be studied using an existing Lagrangian time-dependent finite-difference program which calculates planar, cylindrical or spherical geometries. The effect of promoter concentration gradients on transition will be studied. These results will be presented such that optimum ratios of vapor cloud size to promoter spot size and optimum internal gradients are determined which promote transition from adiabatic explosion to detonation.

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0043, SMOKE VISUALIZATION OF SUBSONIC AND SUPERSONIC FLOWS

T.J. MUELLER, Univ. of Notre Dame, School of Engineering, *Notre Dame, Indiana* 46556 (DF049660; AF-AFOSR-3412-77)

AF function - aerospace vehicles. Opportunity - flow visualization by use of smoke streams can be an excellent method to elucidate the intricate flow patterns for both viscous and inviscid flows. Professor F. N. M. Brown at the University of Notre Dame produced many such visualizations but his results were not widely published. These results and the techniques to produce them should be published to aid present and future experimental aerodynamicists. Objective - to assemble a complete survey of subsonic and supersonic smoke visualization results along with techniques and equipment needed to produce them. How work contributes - new analytical models and numerical computational methods are required to provide more efficient designs for advance aerospace vehicles. Improved visual studies of practical fluid dynamic problems can link the meaning between the measured flow parameters and the governing flow parameters by providing observed flow patterns for the desired ranges.

A wealth of knowledge concerning visual flow results and techniques are available but must be disseminated to be of use. This effort will collect this trove of information in a concise usable report.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0044, NUMERICAL STUDIES OF UNSTEADY SUPERSONIC MIXING FLOWS

J.D. ANDERSON, Univ. of Maryland, School of Engineering, *College Park, Maryland* 20740 (DN775431; N00014-77-C-0257)

Mixing phenomena play a central role in many fluid dynamic applications ranging from the flow at the trailing edge of a wing to the flow in a chemical laser. The proposed research will examine, numerically, the mixing between two co-flowing jets in which oscillations, representative of controlled input disturbances, will be introduced.

In recent years significant progress has been made in the interpretation of the nature of the mixing of two, steady, planar, coflowing jets. The planned numerical work will examine the influence of controlled time-dependent disturbances on the diffusion between the two jets. The calculations will use the time-dependent Navier-Stokes equations. Jets of the same composition as well as dissimilar jets will be studied. For turbulent flows, a kinetic energy model will be used.

ADDENDA: Supporting agency address is: Office of Naval Research Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0045, FRACTURE MECHANICS AND BUCKLING

B. BUDIANSKY, Harvard University, School of Engineering, *Cambridge, Massachusetts* 02138 (DF049000; AF-AFOSR-3330-77)

AF function - aerospace vehicles require improved understanding of fatigue and fracture processes so that designs of enhanced durability can be achieved. Deficiency - current design methodologies for structural failure are empirical in nature and result in premature failures and excessive inspection and spare parts costs. Objective - the principal objective of this research effort is to understand the behavior of cracks and flaws in metallic structures. In particular, this research will investigate the influence of nonlinear material behavior in the vicinity of cracks on crack growth and fracture characteristics. How work contributes - based upon a deeper knowledge of crack behavior, improvements in airframe and engine designs can result which reduce Air Force cost of ownership.

This research is theoretical in nature. Theories will be studied which improve the predictive capability of establishing stress concentration factors when material plasticity is involved. These studies will include plasticity effects on stationary and growing cracks. In addition, plasticity effects on fatigue crack growth will be investigated and retardation factors investigated. Finally, within this framework the influence of creep on crack growth will be examined.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0046, ANOMALOUS ZEEMAN EFFECT IN MOLECULES USING LASER SATURATION SPECTROSCOPY

A. JAVAN, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139

The Zeeman effect in CO2, N2 and other molecules is studied utilizing laser-induced Doppler-free saturation techniques. The anomalous Zeeman effect due to different g-factors of the levels involved is observed for the first time, in sigma molecules. Other aspects of laser saturation spectroscopy are also being pursued.

SUPPORTED BY Massachusetts Inst. of Technology

4.0047, UNSTEADY TRANSONIC FLOW WITH HEAT ADDITION

M. SICHEL, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (ENG76-23982)

Two problems in unsteady transonic flow will be analyzed: 1) to explore the possibility of using similarity series to solve the transonic equations with heating accounting for the existence of shock waves or exothermic discontinuities; 2) to develop a dynamic model of oscillatory condensation for flow where the characteristic reaction or condensation time is much smaller than the characteristic unsteady flow time.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0048, A STUDY OF ANODE PHENOMENA AND ANODE BOUNDARY LAYERS

E. PFENDER, Univ. of Minnesota, School of Engineering, *Minneapolis, Minnesota* 55414 (ENG77-04108)

The object of this proposal is an analytical and experimental study of plasma-wall boundary layers and of anode phenomena induced by MHD effects as well as by melting and/or evaporation of anode material. A stepwise improvement of a previously introduced analytical model offers the opportunity to assess the importance of various effects on the arc in the anode region as, for example, convection and radiative cooling, melting, evaporation, and deviations from local thermodynamic equilibrium. The ultimate analytical models for the anode region are expected to approach experimental conditions so closely as to afford a quantitative comparison between theory and experiment. A previously developed diagnostic method for measuring local anode heat fluxes will be converted into a computer-controlled experiment to allow for a wide variation of arc parameters as well as for an improvement of its accuracy. Preliminary information of the effects of anode melting and/or evaporation on the arc is expected from time-resolved photography and qualitative spectroscopy. These results will be crucial for the development of realistic models which take secondary effects into account. Without secondary effects, the flow field governs essentially the behavior of the arc in the anode region. Laser-Doppler diagnostics is proposed for measuring the flow field. The research will be a continuation, in part, of research done under NSF Grant ENG 7102478.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0049, STUDY OF THE EMP INTERACTION WITH AIRCRAFT OVER AN IMPERFECT GROUND PLANE

C.D. TAYLOR, Mississippi St. University, School of Engineering, *Mississippi State, Mississippi* 39762 (DF048890; AF-AFOSR-3342-77)

AF function - an electromagnetic pulse such as the nuclear EMP incident on an aircraft will induce current and charge densities on its surface. The interior fields are related to the exterior fields and a knowledge of the external fields is the first step in determining the currents and voltages induced in the electrical systems of the aircraft. Simulation facilities to test the response of

aircraft to the nuclear EMP generally require that the aircraft rest on a concrete pad which eliminates the possibility of testing the inflight response. Theoretical models are required to extrapolate the test data from ground-based measurements to predict the inflight response. Deficiency - models are available to predict the induced current density on metallic objects and, generally, the flight mode can be handled. Agreement for the ground alert mode is not as good and proximity to an imperfectly conducting ground plane has not been treated at all. Objective - the singularity expansion method (SEM) will be applied to determine the current and charge induced on models of aircraft (intersecting cylinders and intersecting bodies of revolution) near a ground plane. Contribution -this work will provide usable analytical models for predicting the EMP response of aircraft-like objects located in proximity to an imperfect ground plane. This is an important step in the goal of extrapolating test data to the free-flight mode.

Four tasks will be undertaken: (1) a parametric singularity expansion method (SEM) study of two perpendicular intersecting cylinders parallel to a perfect ground plane. The parameters will include aircraft-like dimensions and heights above the ground plane. Natural modes, natural frequencies, coupling vectors and coupling coefficients are to be obtained. Time domain results will also be obtained, (2) SEM results for two perpendiculat intersecting bodies of revolution parallel to a perfect ground plane are to be obtained and compared with the previous results, (3) SEM results for two perpendicular intersecting cylinders parallel to an imperfect ground is to be obtained using the exact Sommerfeld formulation. Aircraft-like dimensions and heights above the ground plane with typical electrical parameters are to be considered. A comparison with the results for a perfect ground plane will be made, and (4) the time domain results will be verified. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0050, UNSTEADY TRANSONIC FLOWS IN A TWO-DIMENSIONAL DIFFUSER

M. SAJBEN, McDonnell Douglas Corporation, *St. Louis, Missouri* 63166 (DF048360; F49620-77-C-0082)

AF function - advanced aerospace vehicles. Opportunity - increase our fundamental knowledge of the parameters which cause dynamic inlet distortion (fluctuations). Objective - experimentally explore the effects of approach boundary layer properties on the unsteady behavior of two-dimensional, transonic diffuser flow. How work contributes -understanding of the mechanisms responsible for the flow unsteadiness will provide the basis for establishing scaling laws and developing inlet-compressor matching methods that are based on fundamental principles of fluid mechanics.

Appropriate hardware will be designed and built to permit varying the thickness of the boundary layer approaching the inlet throat. A matrix of test parameters will be established adequate to cover all significant fluctuation modes. Oil flow traces and high-speed schlieren movies will be used as visualization techniques. All data will be analyzed and correlated with the visual information contained in the movies and oil traces.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0051, AERODYNAMIC PROBLEMS OF LARGE-SCALE COOLING DEVICES

F.K. MOORE, Cornell University, School of Engineering, *Ithaca, New York* 14850 (ENG76-02516 A01)

This basic study on dry cooling systems will be in part concerned with the viscous flow in an infinite stack of zig-zag plates intended to represent a yawed heat-exchanger array. In particular, various corner configurations will be investigated and heat transfer rates in corner regions will be predicted. A different but related approach to the yawed heat exchanger problem will emphasize the limit of high drag. Classes of devices intended to accomplish reversible turning at 'bundle' entrance, and irrotational flow at bundle exit will be studied. A general concept for best arrangement of heat exchanger bundles in a cooling-tower entrance will be developed, based on smooth bell-mouth entrance flow, and studies of wind-generated swirls in tower entrance flows, already begun, will be completed. More elaborate studies on exit flow will be undertaken in a wind tunnel and a water tank with a travelling jet. Also considered will be innovative flow devices, such as external ring airfoils, for the control of aerodynamic nonuniformities. This will be a continuation of NSF Grant No. ENG 76-02516.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0052, STUDY OF REYNOLDS STRESS EQUATION FOR PREDICTION OF FLOW CHARACTERISTICS OF FREE JET FLOW

Y.G. TSUEI, Univ. of Cincinnati, School of Engineering, *Cincinnati, Ohio* 45221 (DF048510; AF-AFOSR-3311-77)

AF function - advanced combustor technology. Deficiency - lack of knowledge of turbulent flow field within a ramjet dump burner. Objective - develop a computer code which is fast and efficient for calculating the axisymmetric flow into a dump burner that includes turbulent intensity as well as turbulent shear stress. How work contributes - better knowledge of the flow fields through combustors will allow improved design of the ramjet combustion systems. Without the improved flow fields it is not possible to visualize the convection and diffusion of the chemical species needed to obtain combustion efficiency and control heat transfer in the radial direction. This proposal will provide a simplified flow predictive method and will add turbulent intensity to the flow field parameters.

A numerical program will be developed and tested for the prediction of free jet flow characteristics. The program will include terms to predict the decay of centerline velocity, turbulent shear stress, and turbulent kinetic energy generation and dissipation.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0053, THE SURFACE CURRENT AND CHARGE DENSITY INDUCED ON FINITE CYLINDER MOUNTED NEAR A PERFECTLY CONDUCTING GROUND PLANE

W.D. BURNSIDE, Ohio State University, Graduate School, *Columbus, Ohio* 43210 (DF048710; AF-AFOSR-3324-77)

AF function - geometrical theory of diffraction (GTD) analyses have been used with the principle of reciprocity to analyse the surface current and charge density induced on an aircraft in an electromagnetic environment as for example, the nuclear electromagnetic pulse (EMP). The proposed work will apply the GTE technique to structures near a ground plane. Opportunity - previously developed solutions have been used to compute the surface current and charge density for aircraft in a free space environment; however, there is a need for this information when the aircraft is closely coupled with other structures, specifically, the coupling induced by a plane wave incident on a parked aircraft as in an EMP simulator test. Objective - the surface current and charge density induced on a finite cylinder situated above a perfectly conducting ground plane will be analyzed. This solution will be used to determine if large currents or charges are induced due to the open resonator effect, i.e., the finite cylinder and its image. Contribution - this work will provide some basic understanding of the mechanisms associated with closely coupled structures. Two-dimensional open resonator problems have been treated in past work which illustrated the applicability of GTD to solve such problems. However, many questions must be answered in the three-dimensional case which will be addressed in this work.

A GTD numerical solution for the surface current and charge density induced on a section of an infinite two-dimensional cylinder near an infinite ground plane. Using a GTD solution the three-dimensional effects associated with a finite strip and circular cylinder situated above an infinite ground plane will be examined. These two solutions will be combined to compute the total surface current and charge density induced on an infinite strip and circular cylinder near a ground plane. The work will be verified using another approach and also by determining if the solution provides the free space result as the cylinder is moved a large distance from the ground plane. An attempt will be made to

qualify the resonator effect on the surface current and charge densities.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NP Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0054, PHASE COMPENSATION FOR HIGH-POWER LASERS

W.H. CHRISTIANSEN, Univ. of Washington, School of Engineering, *Seattle*, *Washington* 98105 (DF048620; AF-AFOSR-3316-77)

AF function - weaponry. Deficiency - high-power laser beam propagation through the atmosphere from an airborne platform typically suffers a loss of effectiveness associated with a rapid wavering of beam direction caused by phase distortion occurring in the laser cavity, optical components, or the atmosphere between laser and target. Correction of this effect is achieved by introducing compensating phase distortions actively controlled in real time by a sensing and control system. Objective - to study the possibilities and limitations of using gas dynamic flows as optical elements for introducing phase compensations in a coherent adaptive optics system. How work contributes - successful outcome of this work could result in more effective laser beam control as well as substantially reduce the flight weight of laser weapon systems.

Arrays of gas jets of different index of refraction will be controlled to achieve given desired phase distortions of plane electromagnetic waves passing laterally through the jets. Means of controlling these jets at the frequencies needed for adaptive optics will be investigated.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, PARAMETRIC STUDY OF THERMAL STORAGE CONTAINING ROCKS OR FLUID FILLED CANS FOR SOLAR HEATING AND COOLING

H. SAHA, Alabama Agric. & Mech. Univ., School of Technology, *Normal*, *Alabama* 35762 (NSG 8041)

The primary objective of this investigation is to present the test data and an analysis of the heat transfer characteristics and energy storage capability of a solar energy bed utilizing water-filled cans as the energy storage medium. The intent is to optimize and parameterize such aspects as bed and can size, can arrangement, and bed flow rates by experimental and analytical means. This type of storage medium, liquid-filled cans, utilizes the benefits of both solids like rocks and liquids like water. This combination of solid and liquid mediums shows unique heat transfer and heat content charcteristics and will be well suited for use with solar air systems for space and hot water heating.

For the purpose of an extensive parametric study of heat transfer characteristics of rocks, of other solids, and of solid containers filled with fluids - of different shapes and sizes, a multi-flow-cycle storage test facility is designed and built.

The test plan at this time calls for measuring various sizes of tin cans filled with water; placed vertically, horizontally, or at random, for different inlet temperatures (90 degrees F - 200 degrees F), for different mass flow rates (800 cfm - 1600 cfm), and for corresponding pressure drops. The trends of the test results acquired thus far are representative of the test bed characteristics while operating in the various modes.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0002, DEVELOPING REMOTE SENSING APPLICATIONS FOR NATURAL RESOURCE STUDY AND MANAGEMENT

O.L. MONTGOMERY, Alabama Agric. & Mech. Univ., School of Agriculture, *Normal*, *Alabama* 35762 (NGR 01-001-023)

The Department of Natural Resource and Environmental Studies, Alabama A&M University, has addressed the problem of digitizing the transportational arteries of Alabama and placing them in a computerized format compatible with the Alabama Resource Information System (ARIS). The five-county area under the auspices of the Top of Alabama Regional Council of Governments (TARCOG) was selected as the study area. The research focused on the following specific objectives: (1) The digitization of TARCOG area transportation networks consisting of highways, railroads and waterways. (2) The digitization of airports and dock facilities within the TARCOG area. (3) Evaluation of time required when digitizing with one of the following methods: a. Manual, b. Telereadex 29 with Film Reading Digitizing System and c. Digitizing Tablets.

A method for digitizing and storing information from a U. T. M. grid cell base has been developed and tested. It is believed that this system is compatible with ARIS data system. The transportational arteries within the TARCOG area have been digitized and processed in a manner such that the data can be stored, retrieved and updated with minimum program manipulations.

Current plans include an evaluation of the proposed system and a publication of the operational procedures for the completion of this project.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0003, SOIL MOISTURE MODELING

R.D. BORNSTEIN, Calif. State Univ. & Colleges, School of Science, *San Jose*, *California* 95114 (NSG 2184)

A numerical, finite-difference planetary boundary layer model which simulates the flow of moisture through a soil layer has been developed. It is proposed to test the accuracy of the model by validating its predictions against existing observations of soil and atmospheric moisture. The model will then be used in a parametric study, i.e., it will be used to simulate the moisture fields of various types of soil layers under different atmospheric conditions. These results will eventually be used in an operational program involving the use of satellite observations to determine and predict soil moisture content.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0004, COASTAL ZONE COLOR SCANNER SURFACE TRUTH MEASUREMENTS

W.W. BROENKOW, Calif. State Univ. & Colleges, Moss Landing Marine Labs., *San Jose*, *California* 95192 (NSG 2239)

The objective of this grant is to provide sea truth data in support of the Ames effort, in conjunction with the Coastal Zone Color Scanner Nimbus Experiment Team, to develop algorithms for converting high-altitude and satellite radiance data of waters along coastal zones to mapped estimates of chlorophyll and suspended sediment concentrations. During pre-arranged overflights by NASA remote sensing aircraft with a scanner simulating the CZCS, the Moss Landing Marine Laboratory Research Vessel Oconostota will obtain surface and subsurface data according to guidelines provided by the CZCS NET. Biochemical measurements will include chlorophyll a profiles and discrete samples, nutrient concentration, total particulate material, phytoplankton enumeration and particle size distribution. Physical measurements will include salinity and temperature vs. depth, bucket temperature, surface radiation temperature, sea state and meteorological conditions. Optical measurements will include Secchi depth, Munsell color, transmissometer profile, input irradiance, spectral irradiance for upwelling and down welling light at various depths below the surface, path radiance and atmospheric transmission. To date, five CALCOFI cruises provided the opportunity to perfect most of the biochemical and physical measurements; particle size distribution and radiation tempera-

tures remain. Most of the optical measurements await a new, 4 channel radiometer. Participation in the CZCS NET cruise in the Gulf of Mexico provided valuable interchanges on methods and procedures as well as a contribution to a data acquisition and reduction system for spectroradiometer data.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0005, A STUDY TO EXAMINE THE FEASIBILITY OF USING SURFACE PENETRATORS FOR MINERAL EXPLORATION

D.W. ANDERSON, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NSG 2236)

The purpose of this study is to assess the concept, examine the feasibility and identify the technology required for using surface penetrators to help locate mineral deposits on earth and other planetary bodies. Surface manifestations and subsurface characteristics of ore bodies will be examined to determine which features can be measured from sensors on-board penetrators. This examination will conceptually identify various sensor types and sensitivities needed to identify subsurface ore bodies, and determine the optimum penetrator emplacement depth by correlating geochemical characteristics at various depths with mineable ore concentrations. A cost comparison will be performed between past exploration methods and future penetrator methods to determine if the penetrator can be a practicable technique for mineral exploration.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0006, MULTI-DIMENSIONAL CHEMICAL/DYNAMICAL MODELS OF THE STRATOSPHERE AND MESOSPHERE

C.A. RIEGEL, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NCA 2-675711)

Ames and San Jose State University scientists have developed a two-dimensional model that treats the chemistry of minor constituents in the stratosphere and mesosphere and includes bulk flow and eddy transport. This model includes reactions involving nitrogen, hydrogen and chlorine oxides, and is being used to assess the environmental effects of aerospace vehicle operations and of releases of chlorofluoromethanes.

Results of the model calculations are in reasonable agreement with observations; but further refinements are desirable. One set of refinements can be achieved by improving the transport parameters, i.e., by updating the bulk flow by means of more extensive data, and by recalculating the eddy transport in order to bring model results in even better agreement with observations.

In addition, Ames scientists have continued work on a submodel of stratospheric-mesospheric dynamics, and have developed numerical techniques suitable for the ILLIAC (parallel processing) computer. Professor Riegel of San Jose State University is assisting in the development of this model by advising on necessary meteorological approximations and in comparing model performance with observed atmospheric structure.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0007, GOLD, RHENIUM AND SILVER PARTITIONING IN PART OF THE SYSTEM BASALT-FE-FES

R.L. METHOT, Chicago State University, School of Arts & Sciences, *Chicago, Illinois* 60628 (NSG 2188)

It is likely that an early melting episode in the outer portions of the Earth and Moon would have strongly partitioned siderophile and chalcophile elements between silicate phases and phases in the system Fe-S. In order to test this model, using elements which do not fractionate strongly between basalts and their source rocks, we will determine equilibrium distribution coefficients for partitioning of Au, Re and Ag between: (1) Fe-S melts and basaltic liquids as a function of Fe-S composition and temperature; (2) Fe-S liquids and solid Fe. This will be done by heating appropriate compositional mixtures from the system basalt-Fe-FeS to which Au, Re or Ag tracers have been added, and determining equilibrium concentrations of these elements in quenched phases by beta-track mapping.

Initial runs have shown that textures useful for the mapping technique may be obtained for both groups of experiments. Although the data are incomplete, early runs employing beta-active Ag(110M) indicate that distribution coefficients for group (1) experiments may be obtained for reasonable exposure times.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0008, THE THERMOMETRIC PROPERTIES OF MULTICOMPONENT MIXTURES OF ATMOSPHERIC INTEREST

G.H. WALKER, Clark College, Undergraduate School, *Atlanta, Georgia* 30314 (NSG 2143)

This project seeks to measure the partial pressures in the vapor phase above a multicomponent mixture (either liquid or solid). The systems to be studied include those of interest in the study of planetary atmospheres: sulfuric acid-water, sulfuric acid-water-nitric acid, sulfuric acid-nitric acid-water-ammonia. The temperature range will cover from -50C to 25C. Special emphasis is to be placed upon obtaining the vapor pressure of pure sulfuric acid, a quanitity poorly known but important in many theoretical studies. The method being used employs a mass spectrometer system that has been calibrated to the molecular species of interest. Current work centers around the calibration of the mass spectrometer to sulfuric acid vapor.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0009, PRODUCTIVITY AND DECOMPOSITION OF COASTAL MARSHES IN LOUISIANA

F.R. NELSON, Jackson State University, Graduate School, *Jackson, Mississippi* 39217 (NSG 9016)

This work involves the study of certain aspects of primary productivity as related to the vegetation in selected areas of the Louisiana coastal marsh. Training samples of a size compatible with LANDSAT resolution were selected from a transect through the Louisiana marsh from Bayou Lafourchu to Lake Salvador. The distribution of the training samples is such that the complete salinity regimes of the marshland have been encompassed from saline through brackish to fresh. These areas are defined by ERL and maps showing their exact location.

Library research was conducted to relate previous research work with this study. The following have been accomplished: (a) Dominant plant types in the Louisiana marsh (specifically those found in the afore-mentioned transect). (b) Plant species as marsh salinity indicators. (c) Biomass measurement procedures. (d) Marsh primary vs. net productivity. (e) Microbial contributions to marsh productivity.

Studies continue within each of the training samples relative to productivity in the marshland community as follows: (a) Biomass measurement of piant litter (all above-ground portions). Litter bags containing a proportional representation of each dominant or co-dominant plant species found in the training samples were left in situ and checked periodically to determine decomposition rates. (b) Biomass measurement of arthropods and/or micro-consumers as contributors to decomposition within the ecosystem. This investigation involves counting, culturing and microscopic study to quantify the presence of organisms.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0010, ATMOSPHERIC CHEMISTRY - THE MECHANISMS AND KINETICS OF THE REACTION OF OZONE AND STRATOSPHERIC POLLUTANTS

J.H. HALL, Morehouse College, Graduate School, *Atlanta, Georgia* 30314 (NSG 7269)

OBJECTIVE: The primary thrust of this project is to determine the possible reaction mechanisms by which chlorine atoms and ozone molecules react to form chlorine oxides.

APPROACH: Our procedure was to react chlorine atoms and ozone molecules and isolate the products in an argon matrix at 4.8K. The trapped species were then identified by their infrared spectra.

PROGRESS: Previous experiments, in this laboratory, have led to the conclusion that O-Cl-O was the major product of the chlorine and ozone reaction. The reaction products were identified by esr and ir matrix isolation techniques. These experiments were rather limited in scope, however, and we sought to further clarify the results by performing the following experiments: (a) Chlorine atoms reacted with pure 16O2 and 18O2; (b) Chlorine atoms reacted with pure 18O3; (c) Chlorine atoms reacted with 18O3/16O2 mixtures; (d) Diatomic chlorine reacted with 16O3; (e) Diatomic chlorine reacted with 16O2; (f) Chlorine atoms reacted with 16O3/16O2 mixtures of various ratios.

A total of 56 experiments were performed. The reactions were carried out at room temperature, and the products were trapped on CSI cold window (4.8K), and identified by their ir spectra.

From the ir experimental data, coupled with isotopic shift in ir absorption frequencies, the reaction products were identified as OCLO, ClOO, ClO, (ClO)2 and Cl2O. The isotopic studies established unequivocably that these products were produced from the reactions between chlorine atoms and ozone, rather than between chlorine atoms and oxygen. The concentration of a given product is dependent on the relative concentrations of chlorine atoms, ozone, and oxygen.

Although ClO was not observed experimentally, we must infer from our products, that ClO is definitely an intermediate in these reactions. The proposed reaction mechanisms are: Cl plus O3 yields ClO plus O2; ClO plus O3 yields OClO plus O2; ClO plus ClO yields ClOO plus Cl.

The radical ClOO was found to have a short lifetime. The decomposition of ClOO is due to the reaction: ClOO plus M yields Cl plus O2 plus M.

CURRENT PLANS: Efforts are underway to study the role of OClO, ClOO, and Cl2O during photolysis.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0011, ATMOSPHERIC AND ASTRO CHEMISTRY

J.N. GAYLES, Morehouse College, Graduate School, *Atlanta, Georgia* 30314 (NGL 11-008-001)

BACKGROUND INFORMATION: The work supported by this grant is primarily concerned with the role of ionic species in the chemistry of the upper atmosphere. This work is supplemental to that of NSG 07269, and there is some overlap. Specifically, we have been concerned with several photochemical reactions and how they might relate to photochemical smog as well as the photochemical depletion of ozone in the upper atmosphere.

The experimental technique employed in these studies is that of 'matrix isolation' in conjunction with electron spin resonance spectroscopy and optical and infrared spectroscopy. This technique provides a means of producing and maintaining extremely reactive and hence transient species in sufficient concentration for them to be definitely identified and structurally characterized in an isolated state.

PROGRESS/CURRENT PLANS: Attempts to isolate and identify the I.R. peaks of proposed intermediate (OOClO) were unsuccessful. In the process of further investigation, it was found that nitrogen was present in trace amounts in our chlorine tank. Chlorine was then purified by trap-to-trap distillation using liquid nitrogen and liquid nitrogen plus a methanol slush as the traps.

The following experiments were done using purified chlorine and ozone made by the static method.

a) Chlorine and ozone reaction; with different concentrations of chlorine and ozone. b) Chlorine and ozone reaction was studied by varying the length of the 'reaction zone'.

Chlorine dioxides (OClO, ClOO), ClOO, ClO are the products observed in the chlorine and ozone reaction.

The concentration of O-Cl-O decreases vary significantly while the concentration of ClOO, in fact, increases as the ozone concentration is decreased.

The ClOO concentration is significantly decreased as the reaction path is increased, suggesting that ClOO undergoes decomposition.

Variation of chlorine concentration has the expected effect on the concentration of OClO and ClOO.

CONCLUSION: The following reactions are then proposed to be primary reactions in the chemical reaction scheme for gas phase chlorine in our system: Cl plus O3 yields ClO plus O2; ClO plus O3 yields OC1O plus O2; ClO plus ClO yields ClOO plus Cl; ClOO plus M yields Cl plus

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5.0012, EXPERIMENTAL AND THEORETICAL TESTS OF A MODIFIED SUITS MODEL

E.W. LEMASTER, Pan Amer. University, Graduate School, *Edinburg, Texas* 78539 (NSG 9033)

The general objective is to develop an accurate and versatile mathematical model of the bidirectional reflectance and the solar energy absorption of a vegetative canopy. The model is to be applied to wheat and used as a basis for the study of the influences of soil moisture, diffuse skylight, leaf position, total leaf area, sun and observer angles, and plant number density on reflectance and energy absorptance.

THE ACCOMPLISHMENTS TO DATE ARE AS FOLLOWS: (1) study solutions to the Suits reflectance equation; (2) develop the properties of the solutions; a) Helmholtz reciprocity; b) model depth studies for reflectance versus LAI; c) failure of the model for large sun and observer angles; (3) develop a light absorption model; (4) Model parameters were collected weekly for two varieties of spring wheat. There was very little variation in single leaf reflectance and transmittance over the growing season.

Future work will center on correcting the sun and observer angle dependence of the model, studying the influence specular reflectance has on the crop reflectance, and developing a simple method to determine leaf area index for a field.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0013, CLUSTERING OF REMOTELY SENSED MULTISPECTRAL IMAGERY DATA

M. PAO, Savannah State College, Undergraduate School, *Savannah, Georgia* 31400 (NSG 8048)

The objective of this research is to investigate unsupervised classification technique which has direct application to the interpretation of multispectral aircraft and satellite imagery data. The purpose is to partition feature vectors in spectral space into disjoint subsets of similar vectors. The classification procedure being used assumes that peak regions in the histogram correspond to subset centers, and obtains these regions through the following steps: (a) find higher peaks by clustering high-frequency feature vectors, (b) find lower peaks by clustering low-frequency feature vectors which are not located near higher peaks. After peaks (or subset centers) having been found, the procedure uses them to classify all feature vectors.

This classification technique is being tested on a set of four multispectral images taken over Bald Knob Quadrangle, Tennessee. The characteristics of feature vectors in each subset in the resulting classification will be studied, and will be used as a guide in further refining classification technique.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0014, STUDIES ON THE TOXIC ELEMENTS AND ORGANIC DEGRADATION PRODUCTS IN AQUATIC BODIES

AND SEDIMENTS AROUND KENNEDY SPACE CENTER (KSC)
G.S. GHUMAN, Savannah State College, Undergraduate School, *Savannah, Georgia* 31400 (NSG 803)

Beginning September, 1974, studies have been conducted around KSC in the water bodies of Haulover Canal and North Mosquito Lagoon (1st year), North Indian River (2nd year), and South Mosquito Lagoon (3rd year in progress). The objectives of this study are to measure the physical, chemical and biological parameters of these estuaries and assess the base levels of deposition of toxic elements in the sediments. Five sampling trips were made to KSC each year. Water temperature, pH, salinity, conductivity and dissolved oxygen were measured during sampling at the 25 sites. In the laboratory, major and minor metals, bicarbonate, chloride, sulfate, inorganic phosphorus and nitrogen were determined by the atomic absorption, radio-reagent, steam distillation and other standard methods.

The concentrations of major cations ranged Na greater than Mg greater than Ca greater than K in water and Ca greater than Na greater than Mg greater than K in the sediments. Zinc, Mn and Pb concentrations were the highest in water in May and Cd in March. Zinc and Pb concentrations in the sediments peaked in July while Cd was maximum in May samples. The microorganisms have been studied by nutrient enrichment culture technique. Currently, plans are underway to correlate the levels of toxic metal ions with the species of organisms and to study the microbes by employing pyrolysis-gas-liquid (PGL) chromatography technique.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0015, INHIBITOR ANALYSIS FOR A SOLAR HEATING AND COOLING SYSTEM
J.H. TABONY, Southern Univ. A & M College, School of Engineering, *Baton Rouge, Louisiana* 70813 (NSG 8025)

This project is a study of potential corrosion inhibitors for the NASA solar heating and cooling system which uses aluminum solar panels. The research consists of continued testing using the dynamic corrosion system developed in phase one of the grant. The research also consists of an economic analysis of the corrosion inhibitors tested in phases one and two. Very good progress was made and continues to be made in finding a suitable inhibitor for the system.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0016, RELATIONSHIPS OF INFRARED RADIATION AND SELECT ENVIRONMENTAL PARAMETERS IN WHEAT AND SORGHUM FIELDS
E.A. BRAMS, Texas A & M University System, School of Agriculture, *Prairie View, Texas* 77445 (NSG 9006)

The primary objective is to develop ground measurements of select meteorological and soil parameters over wheat and grain sorghum canopies during the growing season and relate these measurements to infrared radiation detected over the canopies. The purpose is to develop relationships through which air temperatures (2 m height), soil temperature and moisture (6 cm depth) can be predicted from infrared canopy temperatures. The experiment is located in South Texas Gulf Coast on sandy loam soil testing 4.5 acres of grain. Regression equations were developed relating air and radiative temperatures over a wheat canopy at 1500 hours (CST) readtime only during discrete 10-day intervals over the growing season. Inferences of air temperatures at 1500 hours derived from thermal infrared radiation taken at 0900 and 2100 respectively were not valid in this experiment. Tenuous relationships were also evident between radiative temperatures at 0900 and 2100 and mean daily temperatures. Regression equations relating these latter parameters would not be useful based on the results of this experiment. The results suggest that infrared patterns over wheat from satellite-derived measurements would be more useful taken at time of highest daily temperature (1500 hrs.). The regression equations relating radiative and air temperature can be used to predict air temperature over wheat canopies. Plots of soil temperature (6 cm depth) have similar patterns to air and radiative temperature throughout the growing season. This close relationship permits estimation of soil temperature from either parameter which is very useful for estimating growth and yield of wheat. Additional ground measurements planned over wheat and grain sorghum canopies will include wind velocities and directions at 10M and canopy heights, solar radiation and evapo-transpiration rates and soil moisture.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0017, AN INVESTIGATION OF ABSORBER AND RADIATORS FOR SOLAR POWER SYSTEMS
J.P. SELLERS, Tuskegee Institute, School of Engineering, *Tuskegee Institute, Alabama* 36088 (NSG 8054)

A high-efficiency absorber is essential for the economical operation of thermal solar space power systems. It was established in an earlier study that the reradiation losses from the absorber can be reduced utilizing spectral selective surfaces and a light-pipe geometry. Additional information is needed, however, particularly pertaining to the effect of the temperature level of the absorber, the absorber's length and its surface properties on the efficiency. In addition, preliminary data have shown that the light-pipe selective surface absorber compared to a black-body cavity has the capability of operating efficiently at lower concentration ratios and the beneficial impact of this result on the system will be determined. Experimental data will be obtained on a model concentrator-receiver.

Progress to date has been made on the study of surface properties and supplies have been ordered for the experimental program. The model concentrator-receiver being built in Huntsville is over 75% completed.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0018, THE DEVELOPMENT OF AN 'IN SITU' SAMPLING DEVICE FOR NATURAL WATERS
I.R. URZENDOWSKI, Univ. of Albuquerque, Undergraduate School, *Albuquerque, New Mexico* 87105 (NSG 3092)

Effective water pollution control depends on accurate scientific data on existing water quality. Adequate measurement capabilities are necessary to define standards for environmental surveillance. The purpose of this is to develop and 'in situ' filtration system which will operate at the river site. The apparatus will automatically separate suspended sediment according to particle size and preconcentrated metal ions on ion exchange papers. The filters holding the suspended sediment as well as the ion exchange papers containing the metal ions will be returned to the laboratory and analyzed by energy dispersive X-ray fluorescence or atomic absorption.

The apparatus (developed at NASA in 1976) consists of: 1) an electronic pack containing switches, relays, and timers, 2) a wastewater sampler to lift water from river, 3) a pegboard holding a series of filter holders, and 4) a recirculating pump to preconcentrate the metal ions on ion exchange papers. Preliminary studies are now being made at the laboratory before the sampler will be placed in the field.

To study the efficiency of the automated system and to determine the effect of effluent discharges from the Albuquerque sewage treatment facility, weekly measurements of metals ions in water and suspended sediment will be made near and far from the plant. Tests for coliform bacteria will also be made.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0019, DYNAMICS AND MICROPHYSICS OF STABLE OROGRAPHIC CAP CLOUDS; COMPARISON BETWEEN THEORY AND OBSERVATION
K.C. YOUNG, Univ. of Arizona, Inst. of Atmospheric Physics, *Tucson, Arizona* 85721 (ATM77-04287)

The objectives of this research are two-fold; namely, model development and model verification. Two types of models will be developed. A three-dimensional, dynamical model will be developed in order to describe the flow field over and around Elk Mountain to be used as input into the microphysical model. A three-dimensional, microphysical model will be developed based on an existing two-dimensional model of orographic precipitation. The models will be restricted to cases where the flow within the cap cloud is stable and reasonably steady-state.

Model verification will be undertaken in two stages. First, aircraft observations of the thermodynamic variables and winds will be used in verification of the dynamical model. If the agreement between the model predictions and the observations is felt to be deficient, the observations will be used to improve the predicted flow field.

The predictions of the microphysical model will be compared to airborne and ground-based microphysical observations. Comparisons will emphasize the types and sizes of particles and the precipitation rate at the ground.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0020, ARCTIC TROPOSPHERIC AND STRATOSPHERIC WINDS MEASURED BY RADAR TECHNIQUES

N.J. CHANG, Stanford Research Institute, *Menlo Park, California* 94025 (ATM77-16213)

This grant funds a developmental and experimental investigation of the dynamics and structure of the Arctic troposphere and stratosphere using the Chatanika incoherent scatter radar. Using newly developed techniques, this radar will obtain wind profiles on a rapid and repetitive basis. Particular areas to be investigated include exchange mechanisms between the troposphere and stratosphere, stratospheric warmings, and turbulence. Successful development and implementation of this technique will give us a powerful new tool for studies of the low and middle atmosphere.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0021, DEVELOPMENT OF AN ACOUSTIC SOUNDER NETWORK FOR AIR POLLUTION AND LAND USE APPLICATIONS

P.B. RUSSELL, Stanford Research Institute, *Menlo Park, California* 94025 (ENV73-02918 A03)

Two of the most important atmospheric parameters in determining the transport and dispersion of air pollution are winds and the 'mixing depth' -- the depth of the mixed layer of the atmosphere through which surface-generated pollutants can freely mix. The influence of mixing depth in determining ambient pollution concentration is especially strong in urban areas of the West Coast where the characteristic marine inversion restricts the mixing depth to lower altitudes. Pronounced topographic and demographic variations in certain urban regions also cause both the inversion height and wind to vary considerably on small scales in space and in time. As a result, climatological data on both mixing depth and winds must be provided on rather fine spatial and temporal scales in order to be useful to planning in such areas. This project is evaluating the application of a network of acoustic sounders for reliable, unattended and continuous observations of mixing depth over the San Francisco Bay Area. This project is developing analysis and interpretation techniques for deriving mixing depths and other information; evaluating the utility of the acoustic sounder for measuring mixing depth; and disseminating data and methodology to appropriate land use planning agencies and air pollution monitors.

This award is a supplement to Grant AEN-7302918.

SUPPORTED BY U.S. National Science Foundation, Div. of Advanced Energy & Resources Research & Technology

5.0022, INTERANNUAL AND SPATIAL VARIATION OF TROPICAL WAVES

C.P. CHANG, U.S. Navy, Postgraduate School, *Monterey, California* 93941 (8-191; 7-11030)

TECHNICAL OBJECTIVE: The objective of the proposed research is to continue to study the relationship between sea surface temperature (SST) variation and synoptic scale tropical waves using satellite and analyzed wind data to 1) compare the convective fields of the waves between two anomalous periods and 2) investigate the inter-relationships between the continuous time evolution of the wave structure and characteristics, the basic-state mean flow, and the SST.

APPROACH: Only three months of satellite brightness averages are available. Therefore, a brightness percentage will be estimated from visible and IR images as well as cloud cover data estimated by nephanalysis will be used. Because both types of data are subjectively derived, they will be compared objectively with the NESS digitized brightness data in order to evaluate the relative qualities of these data with respect to various purposes. These two types of data, together with the wind, temperature and humidity data used previously in the spectral analysis, will then be utilized to carry out a composite study of the wave structure during two anomalous periods, May-Dec 1972 and 1973.

RESULTS AND PLANS: Results of the first year's study show the following. Main similarities in the wave structure and properties between the two anomalous periods are: (a) the dominant periodicities are four to five days; (b) the zonal wavelengths are close to 3300 km in the lower troposphere; and (c) a general out-of-phase relationship exists between low-level (1000-600 mb) and high level (above 300 mb) meridional wind components. Main differences between the two anomalous periods are: (a) the 1972 (warm anomaly) waves show an equivalent barotropic structure with an abrupt vertical phase shift near 180 degrees at about the 300-400 mb layer while the 1973 (cold anomaly) waves show a continuous vertical phase tilt; (b) the thermal structure of the 1972 waves is well defined with a warm core in the middle tropsphere, whereas in 1973 it is quite poorly defined; and (c) the amplitude of the low-level (below 300 mb) waves is everywhere higher in the 1972 period than 1973.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0023, NORTH PACIFIC EXPERIMENT - A HYDROGRAPHIC INVESTIGATION OF LOW-FREQUENCY BAROCLINIC RESPONSE OF THE NORTH PACIFIC CURRENT TO WESTERLY WINDS

W.B. WHITE, Univ. of California, Scripps Inst. of Oceanography, *San Diego, California* 92038 (OCE76-10177)

This project is part of the North Pacific Experiment (NORPAX). The long-range goal of NORPAX is to understand long-period, large-scale ocean-atmosphere coupling.

A region of the North Pacific Ocean from 140-180W, 30-50N has been chosen for intensive monitoring over the next few years. Merchant ships and naval aircraft will make sufficient expendable bathythermograph (XBT) observations so that the thermal structure in this intensive monitoring region can be mapped every two weeks. Over this same region, surface currents will be determined by means of satellite-tracked surface drifters. This project will provide high-quality hydrographic observations from research ship cruises in this intensive monitoring region in June and October 1976 and April 1977. These hydrographic data will be used to (1) determine the changes in the characteristics of the pycnocline from summer to fall to spring; (2) check the accuracy of the XBT coverage provided by the merchant ships and naval aircraft; and (3) provide the necessary salinity relationships so that dynamic computations can be computed from temperature (XBT) data.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0024, IONOSPHERIC ACCELERATION MECHANISMS

R.D. SHARP, Lockheed Missiles & Space Co., *Sunnyvale, California* 94088 (ATM77-09853)

This grant will support the analysis of selected portions of the data from the energetic ion mass spectrometer experiment on the Air Force satellite 1976-65B. The experiment measures ions in the energy range 0.5 to 16.0 keV and separates the ionic components on the basis of mass per unit charge. The central focus of

the investigation will be the understanding of the mechanisms responsible for the energization of ambient ionospheric ions which have been observed flowing upward out of the ionosphere into the magnetosphere with energies in the keV range. One important objective of the research will be the identification of the origin of the trapped particles in the Van Allen radiation belts.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0025, OBSTRUCTIONS TO VISIBILITY
K.B. EARNSHAW, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8AA7 34 14)

PROJECT OBJECTIVE: Test and modify, if necessary, an instrument to detect and distinguish among various obstructions to visibilty such as rain, snow, dust, etc.

CURRENT YEAR PLAN: Install the device in Boulder and observe its response to various types of weather.

PROGRESS REPORT: Construction is nearly complete.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0026, BERING SEA OCSEP CURRENTS
D.V. HANSEN, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (R7120816)

PROJECT OBJECTIVE: To obtain Lagrangian current data for the Bering Sea OCSEP Project.

CURRENT YEAR PLAN: Free drifting buoys are to be deployed in the Bering Sea, Bristol Bay area, for subsequent tracking by the NIMBUS-6 Satellite. Lagrangian current data and statistics will be computed from the buoy trajectories.

SUPPORTED BY U.S. Dept. of the Interior, Bureau of Land Management

5.0027, CONCENTRATION MODULATION FOR REMOTE DETECTION OF STACK POLLUTANTS
F.S. BARNES, Univ. of Colorado, School of Engin. & Appl. Sci., *Boulder, Colorado* 80302 (ENG77-05308)

This investigation is concerned with the development of methods for enhancing detection schemes for remote monitoring of various pollutants emitted from smoke stacks and other sources. The major technique to be investigated involves periodic modulation of the concentration of specific constituents in the sampled region by intense ultraviolet illumination combined with detection of infrared or other wavelength emissions from the modulation products. Signal-to-background emission noise enhancement is provided by differential detection and signal integration techniques. Electronic systems necessary to perform the signal processing will be constructed and measurements will be made on the gases NO2, SO2, and NH3.

This is a continuation of research previously supported under NSF grant ENG-7415276.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

5.0028, GEOTHERMAL RESOURCES OF COLORADO AND UTAH
G.L. GALYARDT, U.S. Dept. of The Interior, Geological Survey, *Denver, Colorado* 80225 (C-70-74)

STATES TO WHICH PROJECT PERTAINS: Colorado, Utah.

An airphoto geologic map of the Crater Springs KGRA, Utah, and immediate vicinity has been compiled. Final drafting and technical review will be completed early in 1977. Publication will follow.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Div. of Conservation

5.0029, APPLICATION OF PLATE TECTONICS TO THE LOCATION OF NEW MINERAL TARGETS IN THE APPALACHIANS
J. KUTINA, Amer. University, Graduate School, *Washington, District of Columbia* 20016 (AER76-81807)

American University (AU) is undertaking geological research with the broad objective to upgrade significantly our knowledge of the structural control of ore deposits in the Appalachians. The new knowledge will be established in a framework of plate tectonic processes (the new global tectonics) and the long complex history of movement, collision and breakup of the North American plate.

Specific research objectives are: 1) to compile a prognosis map for mineral exploration in the plate tectonic evolution and the pattern of major fractures of the North American plate; 2) To examine the possibilities of finding new mineral deposits at the intersection of the Appalachian orogen by deep-seated, continent-scale fractures and to delineate target areas for more detailed mineral exploration; and 3) To reexamine the mineral potential of the Triassic basins of the Appalachians in the light of their evolution within the global tectonic history of the North American plate.

AU will apply the concepts of global tectonics, together with remote sensing technology, for the analysis of a broad region in the Appalachians. Smaller area targets will be selected for more intensive analysis. As the analysis progresses from a broad view afforded by the satellite imagery to local coverage, remote sensor imagery will be supplemented by field observation and comparative analysis of available geophysical data.

SUPPORTED BY U.S. National Science Foundation, Div. of Advanced Energy & Resources Research & Technology

5.0030, NORTH PACIFIC EXPERIMENT (NORPAX) - LAGRANGIAN CURRENT MEASUREMENTS FOR PHASE I OF THE NORPAX EQUATORIAL PROGRAM
D. HANSEN, U.S. Dept. of Commerce, Atlantic Ocean. & Meteor. Lab., *Miami, Florida* 33132 (OCE77-16827)

This project is part of the North Pacific Experiment (NORPAX). The long-range goals of NORPAX are to understand fluctuations in the upper layers of the Pacific Ocean with time scales of months to years and space scales in excess of 1,000 kilometers and to determine the relationship of these oceanographic fluctuations to the overlying and adjoining atmosphere. Achievement of these goals should eventually lead to improved weather/climate prediction for the Equatorial Pacific Ocean and the American continents.

As part of the NORPAX Equatorial Program in the winter of 1977-78 this project will deploy four drifting buoys on each of three transits of a research vessel across the Equatorial Pacific Current System. The buoys will be equipped with drogues so that they will approximately follow the water in the upper layers of the ocean. The trajectories of the drifting buoys will be monitored by the RAMS position fixing system aboard the NIMBUS-6 satellite. In addition to giving information on currents, three of the buoys will support chains of temperature sensors to observe the depth of the warm layer. The principal objectives of this project are to obtain information on the spatial structure of surface currents in the region of the Equatorial Countercurrent and to help interpret other physical oceanographic measurements which will be taken by other NORPAX scientists at the same time.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0031, OBSERVATION AND STUDY OF FLORIDA CONVECTIVE STORMS
R.M. LHERMITTE, Univ. of Miami, School of Marine & Atm. Sci., *Miami, Florida* 33149 (ATM77-07982)

This research program is directed towards the understanding and study of thunderstorm circulation physics and dynamics and will include two experiments both to be conducted at the Kennedy Space Center during summer 1977 and 1978. It includes the interpretation of the motion fields observed inside thunderstorms by a network of two or three Doppler radars.

The first objective of the research effort is to achieve an adequate three-dimensional description of (1) motion fields (and associated parameters such as convergence and vorticity), (2) radar reflectivity (leading to precipitation intensity and precipitating liquid water content), and (3) mean terminal velocity of the precipitation particles if allowed by the availability of a third radar.

The next objective is the interpretation of these three-dimensional fields to specify the significance and importance of the processes involved in the development of convective storms such as storm circulation, intensity, the formation and evolution of precipitation, the production and dissipation of electricity, etc., so that a descriptive model of the convective storm would be achieved.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0032, NAVY ENVIRONMENT - BEACH-INLET TRANSITIONAL ENVIRONMENT

R.A. DAVIS, State University of Fla. Sys., School of Natural Sciences, *Tampa, Florida* 33620 (DN775283; N00014-77-C-0151)

The objective of this study is to resolve the nature and extent of the transitional zone between tide-dominated inlet environments and wave-dominated adjacent beach environments, and to assess the feasibility of a long-term comprehensive modeling study of this transitional zone. An inlet can cause significant perturbations on adjacent nearshore environmental parameters and thereby degrade the quality of environmental predictive models employed in support of Navy/Marine Corps coastal operations.

Two short field investigations will be conducted at Johns Pass and Matanzas Inlet on the coast of Florida in early CY 77. Parameters to be monitored include wind speed and direction, wave height and period, wave direction and nearshore orientation, tidal currents, longshore currents, and water level. Detailed surveys of bathymetry and coastal morphology will be made. Waves and longshore currents will be measured at multiple locations on both sides of the inlet several times during the experiment. Other inlets will be studied through the use of aerial and satellite imagery and existing data sets.

ADDENDA: Supporting agency address is: Office of Naval Research Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

5.0033, POLARIZATION DIVERSITY APPLIED TO METEOROLOGY

J.I. METCALF, Georgia Inst. of Technology, Georgia Technical Res. Inst., *Atlanta, Georgia* 30332 (DF248430; F19628-77-C-0066)

AF function - improvement of radar detection and identification of aerospace operational hazards. Deficiency - degradation and ambiguity in radar displays because of weather. Development - investigate polarization techniques for interpreting radar information and eliminating extraneous radar echoes. How development contributes -provides improved detection, identification and interpretation of weather echoes in radar displays.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LY Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0034, THE EL NINO CYCLE

C.S. RAMAGE, Univ. of Hawaii, School of Arts & Sciences, *Honolulu, Hawaii* 96822 (ATM76-16737)

The objective of this research is understanding of the connection between the atmosphere and the El Nino cycle. Atmospheric data will be acquired and analyzed to provide lateral heat and momentum transports and to provide patterns of wind stress and vertical ocean-atmosphere heat exchange. Estimates of open-ocean rainfall will be made from satellite infrared cloud photographs.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0035, RAPTOR NESTING AND FEEDING BEHAVIOR IN THE SNAKE RIVER BIRDS OF PREY NATURAL AREA, IDAHO

S.R. PETERSON, Univ. of Idaho, Forest Wldlfe. Exp. Station, *Moscow, Idaho* 83843 (0070009; IDA-ES-0116)

OBJECTIVE: Measure the quantity of food necessary to fledge prairie falcons in the Birds of Prey Natural Area; examine nesting density in relation to cliff relief; investigate post-fledging mortality.

APPROACH: Food habits of prairie falcons will be examined by direct observation of adults feeding young, remote camera facilities, and pellet analysis. Just prior to fledging, a sample of young birds will be fitted with tail-sutured radios to study post-fledging mortality. After fledging, characteristics of scapes will be measured to determine the most productive areas for nesting success.

PROGRESS: Two prairie falcon nests were watched from dawn to dusk during May and June. Radio transmitters were attached to the adults and remote-controlled movie cameras were installed in the scrapes (nests). Food items brought to the nest were recorded by both visual observation and the automatic camera. Food catching outside the nest was observed 20 times. This had not been recorded previously in prairie falcons. Analysis of food items by different techniques is continuing and refinements in the camera techniques will be incorporated into this summer's field season.

SUPPORTED BY Idaho State Government

5.0036, SNOW SHOWER CLOUD PHYSICS

R.R. BRAHAM, Univ. of Chicago, School of Physical Sciences, *Chicago, Illinois* 60637 (ATM77-08970)

This research will analyze measurements made on winter storms from Champaign, Illinois, during the 1975-76 winter seasons and compare these measurements with previous findings from summer conditions. The analysis will in part be directed towards defining future field investigations of the intense snow storms which generate on the lee shore of Lake Michigan during the early winter months when cold air flows over the relatively warm lake.

The analysis will include the following: 1. Theoretical study of the physics governing snow particle size spectra using data from Champaign, Illinois. 2. Analysis of data on droplet spectra in super-cooled winter stratus to evaluate crystal-droplet collection efficiencies which govern the riming potential for winter clouds. Riming growth is known to be extremely important for lake snow storms. 3. A comparison of droplet spectra measured by various techniques on the aircraft with an evaluation of the new device based on light scattering. 4. Analysis of satellite photographs and radar data to establish some of the characteristics of winter mesoscale systems over Lake Michigan with emphasis on defining future field studies.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0037, ASSESSING MIDWEST CLOUD CHARACTERISTICS FOR WEATHER MODIFICATION

B. ACKERMAN, Univ. of Illinois, State Water Survey Division, *Urbana, Illinois* 61802 (ENV77-11527)

The objectives of this research are to 1) compile and analyze sample statistics of variables important in cloud development and precipitation processes and their modification as a function of mesoscale and macroscale atmospheric phenomena, 2) determine relationships of the interior cloud variables and other cloud parameters, environmental conditions and the observed precipitation, and synthesize the results of the analysis, and 3) investigate the adequacy for the Midwest of the predictions from the one-dimensional models used for cloud seeding operations. This research will lead to design parameters for a Midwest precipitation-augmentation experiment.

The research involves the analysis of in-situ cloud observations from aircraft in combination with radar, rainfall, special radiosonde, and other supporting measurements. Particular emphasis is placed on bulk cloud condensate and its partition between cloud and precipitation water.

Utilization activities include widespread dissemination of the results to the user community, such as various governmental agencies, commercial cloud seeders, farm groups and others. Two organizations especially involved in utilization of weather modification technology are the North American Interstate Weather Modification Council and the Weather Modification Association.

SUPPORTED BY U.S. National Science Foundation, Div. of Advanced Environmental Research & Technology

5.0038, EFFECTS OF MAN'S USE ON FORESTED WATERSHED ECOSYSTEMS

R.F. WITTWER, Univ. of Kentucky, Agric. Experiment Station, *Lexington, Kentucky* 40506 (0060578; KY00603)

OBJECTIVE: Determine ecological consequences of man's use of forested watershed ecosystems. Provide basline data obtained from undisturbed and managed watersheds to be used as gauge of environmental degradation in forested and other ecosystems.

APPROACH: Effects of various forest management practices and potential environmental pollutants on water quality and quantity, cycling of nutrients, and energy balance, as well as productivity of forest watershed ecosystems, will be evaluated. Comparisons will be made between undisturbed (control) and managed (treated) watersheds. Instrumental weirs located in minor and major headwater streams will serve as monitoring stations for evaluating water quality and quantity. Total tree biomass will be evaluated to ascertain nutrient cycling budgets in forest vegetation.

PROGRESS: Water quality and quantity monitoring continued on six instrumented forested watershed ecosystems on Robinson Forest. Basic data acquired will be used for watershed calibration and baseline information. One of the gauged watersheds (Field Branch) was fertilized in late April to determine effects of forest fertilization on wildland water quality. Ammonium nitrate was applied at a rate of 450 lbs./acre by helicopter. Movement of nitrate nitrogen (NO (-n)) through the soils and in surface and subsurface waterflow has been closely monitored. During and immediately following fertilizer application NO (-n) values exceeded 100 mg/l in streamflow on the watershed. During December NO (-n) values in streamflow were still approximately 25 times greater than before treatment, but below level established for drinking water standards. The quality of water received as precipitation on the watershed is also being monitored in order to establish a budgeted nutrient cycle. Preliminary sampling indicates the precipitation is quite acidic, with minimum pH values of 2.90 and an average value of 5.40. The project is also providing basic water quality data and land use ground truth for the development of a land use-water quality model utilizing remotely sensed imagery (aircraft and spacecraft).

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Kentucky

5.0039, NATIONAL WEATHER SERVICE - EXPLORATORY INSTRUMENTATION

M.J. SANDERS, U.S. Dept. of Commerce, Equipment Development Lab., *Silver Spring, Maryland* 20910 (8AA8103)

TECHNICAL OBJECTIVE: (1) Automation of the 'cloud height and cloud amount' observation. (2) automation of the 'present weather' observation. (3) Development of an economical pressure sensor for AMOS/RAMOS.

APPROACH: (1) Determine the feasibility of the 'infrared stereo radiometer' concept in estimating cloud height and amount. (2) Develop a pattern recognition machine which automatically classifies laser 'present weather' signatures. (3) Evaluate the surface acoustic wave (SAW) pressure sensor for the AMOS/RAMOS.

PROGRESS (July 1975 to October 1976): Primary emphasis in the development of next-generation sensors has been geared toward the automation of manual observations. An infrared (IR) stereo radiometer experiment is being devised to determine the feasibility of deriving cloud height and amount by correlating infrared radiation measurements from two separate ground-based radiometers. An experimental laser 'present weather' identifier designed by NOAA's Wave Propagation Laboratory is being evaluated as a means for automating the observation of 'present weather'--rain, snow, sleet, hail, etc., by analyzing the interaction of visible and infrared radiation with hydrometeors and lithometeors. The testing and evaluation of various types of no-moving-parts anemometers, including hot film, vortex-shedding and a differential pressure orthogonal air speed sensor, is underway. Seven surface acoustic wave (SAW) oscillator pressure sensors were designed, fabricated and tested extensively. Since a single SAW oscillator pressure sensor is highly temperature sensitive, a dual oscillator design is required to alleviate the temperature effects.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service

5.0040, AUTOMATED WEATHER FORECASTING

W.R. TAHNK, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF248210)

AF function - weather-sensitive aircraft and missile operations. Deficiency - inadequacy of present short-range forecasts of fixed-base and enroute weather conditions. Objective - develop and evaluate new techniques for operational weather forecasts. How development contributes - provides a rational basis to update and improve the operational effectiveness of weather warnings and forecasts through conversion from manual to automated observing and forecasting systems.

The development program has two phases. The first deals with the establishment of an automated system for 0-3 hr forecasts of cloud base height at fixed-base locations. The techniques will be incorporated into the modular automated weather system (MAWS). The second phase deals with the development of generalized weather forecasting techniques for periods up to 6 hours based upon automated surface observations and geostationary satellite imagery.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LY Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0041, SNOW/CLOUD DISCRIMINATION

F.R. VALOVCIN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249500)

AF function - weather analysis and forecasting for military operations. Deficiency - lack of adequate information to meet military weather support requirements. Objective - to recommend operational techniques and an optimum sensor design to AWS/SAMSO to discriminate clouds and snow backgrounds. How development contributes - provides an efficient and unambiguous operational procedure for distinguishing clouds from snow backgrounds as well as distinguishing ice clouds from water clouds.

Analyses of magnetic tapes of previously collected aircraft snow/cloud measurements using digital conversion and Fourier analysis equipment will be initiated. Additional observations using the optical physics instrumented KC 135 aircraft will be made to acquire a representative sample of snow and cloud measurements under a variety of meteorological conditions. Based on the analyses of these data, a recommendation for an operational instrument will follow.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory OP Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0042, AURORAL OPTICAL STUDY

R.H. EATHER, Keo Consultants, *Newton, Massachusetts* (DF248640; F19628-77-C-0097)

AF function - communications and detection. Deficiency - understanding effects both of precipitating particle and non-particle produced ionospheric disturbances which degrade communications at high and equatorial magnetic latitudes. Objective - investigate ionospheric disturbance phenomena by means of auroral spectral emission features measured with a sensitive TV system. How research contributes -provides a new and powerful

technique for large-scale and high-time-resolution auroral measurements. Coordination with other simultaneous measurements from the AFGL Airborne Ionospheric Observatory, NKC-135 aircraft, number 53131, will allow comprehensive measurements of ionospheric response to substorms over sub-auroral, auroral and polar cap domains.

Perform comprehensive investigation of the latitude and local time behavior of large-scale ionospheric disturbance phenomena resulting from auroral particle precipitation in the vicinity of the auroral oval. This investigation will be based primarily on ground and airborne all-sky imaging photometer, all-sky camera and meridian scanning photometer auroral measurements.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0043, SOIL SURVEY AND SOIL CHARACTERIZATION, MINNESOTA

R.H. RUST, Univ. of Minnesota, Agric. Experiment Station, *St. Paul, Minnesota* 55101 (0001836; MIN-25-015)

OBJECTIVE: Inventory, classify, and make multiple use recommendations of the soils of the State. Find and evaluate the principal physical, chemical, and mineralogical properties of the soil taxonomic units.

APPROACH: Within the guidelines of the National Cooperative Soil Survey, the Station will cooperate with the designated Federal agencies (Soil Conservation Service, Bureau of Indian Affairs, Forest Service) to initiate and complete detailed surveys in selected areas of the State. A present, and continuing effort, is to provide a large-scale (1:250,000) soil landscape unit map of the State by geologic quadrangles (total of 11) within a 4 to 5 year schedule. The preparation of interim interpretive reports of survey areas (prior to a final correlated soil map) will be made with emphasis on individual maps and associated interpretation. Continued effort will be made to process map information and characterization data (physical, chemical, mineralogical) in such manner as to facilitate automatic data processing which, in turn, will permit broader dissemination of the data to soil technicians.

PROGRESS: The detailed soil surveys of Freeborn and Cottonwood counties were completed in the work of the Cooperative Soil Survey. Field reviews of the progress of detailed surveys were made in Olmsted, Itasca, Ramsey, Washington, Stearns, Dakota, and Clay counties. Funds received from the Legislative Commission on Minnesota Resources are being used to initiate and accelerate surveys in Ramsey, Houston, Yellow Medicine and Pennington counties. A highly detailed survey was made of the Crookston experimental field (1600 a.) at a scale of 1:4800. In the Soil Atlas project compilation of field work on a stable base at a scale of 1:125,000 was completed on all remaining 8 sheet areas. Lithography is in progress on the Stillwater, Duluth, and St. Cloud Sheets. A one-piece general soil of Minnesota at a scale of 1:500,000 is under construction. The use of color infrared imagery for the detailed soil survey is under study in Clay County. Laboratory characterization was completed on 220 soil profiles sampled in the course of ongoing surveys in 17 counties.

SUPPORTED BY Minnesota State Government

5.0044, PROBLEM IDENTIFICATION AND ASSESSMENT FOR AQUATIC PLANT MANAGEMENT

J.L. DECELL, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (31567)

OBJECTIVE: The overall objective of this work will be the identification and assessment of problems both directly and indirectly associated with aquatic plant management in the nation's waterways. Identification, assessment, and description of problems related to aquatic plant management are a necessary prerequisite to the efficient application of available and future solutions. One area of research currently being addressed is the development of rapid techniques for locating and identifying problem aquatic plant populations. The specific objective is the development of an operational capability to map the distribution and character of problem emergent and submerged aquatic plant species. This capability will also be used to monitor the effects of control operations. The other research area has as its objective the development of a system for classifying aquatic plant problem areas into categories related to available control procedures whereby operations personnel can readily determine the appropriate mix of control techniques and equipment that is applicable for a certain category. The overall objective is to produce a catalog for categorizing the total environmental setting of different areas where aquatic plant problems occur. Other areas of research in this unit will be identified as dictated by need, funds, and personnel availability to perform the work.

APPROACH: The approach of the research pertaining to rapid surveys will be to review previous applications of remote sensing techniques for acquisition of data related to aquatic plants and conduct a theoretical and experimental study to determine the capability for acquiring the desired types of information from photographic, multispectral, and scanner systems. Once an adequate system has been identified, procedures for operational mapping of the most basic data types related to the distribution of aquatic plants will be developed, followed by development of procedures for operational mapping of more difficult to obtain parameters such as plant species density, and growth stage. Because of their differing characteristics, studies for emergent and submerged plant species will be conducted separately. The final effort will involve development of cost-effective, rapid automated data extraction and display capability for use by the Corps as part of its aquatic vegetation management operations. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Army, Corps of Engineers

5.0045, SEVERE STORMS RESEARCH

J.T. SCHAEFER, U.S. Dept. of Commerce, Natl. Severe Storms Forec. Ctr, *Kansas City, Missouri* 64106 (W30911 TD)

TECHNICAL OBJECTIVE: The NSSFC-TDU concentrates on the synoptic-dynamic aspects of severe thunderstorm forecasting. Its basic mission is to bridge the gap between the basic research community and the operational forecasters. Specifically, forecast techniques will be developed to increase the temporal and spatial accuracy of the NWS severe local storm watch program.

APPROACH: The NSSFC-TDU program can be roughly divided into five basic categories: (1) remote sensing applications, (2) advanced data analysis, (3) subsynoptic energetics, (4) subsynoptic dynamics, and (5) dynamic climatology.

The remote sensing applications project is aimed at bringing dynamic reasoning into the interpretation of radar and satellite observations.

New data analysis techniques are being developed that allow the partitioning of energy across the spectrum. It is our goal to produce automated analysis of mesoscale data fields.

Upper air data can be analyzed so that short-term energy conversions are identifiable. Such conversions should be interpretable as an indicator of pending subsynoptic scale development.

The dynamics of mesoscale development are largely unknown. We intend to explore the basic observations to glean insights into the differences between tornadic and non-tornadic storm environments.

A dynamic climatology of tornadoes is being generated. Through post-analysis of the historical data, the regional and diurnal characteristics of tornado occurrence can be learned.

PROGRESS: Developmental work on the analysis technique has begun. The dynamic climatology data base is being generated. Documentation of the radar observable life-cycle of the severe convective storm is progressing, and the first draft of a technical memorandum on the subject has been completed.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service

5.0046, FIRE IN NATURAL FOREST STANDS - INFLUENCES AND SMOKE DISPERSAL

R.W. STEELE, U.S. Dept. of Agriculture, Forestry Sciences Laboratory, *Missoula, Montana* 59801 (0062586; MONZ03005)

OBJECTIVE: Explore key responses to, and impacts of, fire in a natural forest stand. Information obtained will serve to indicate the times and conditions when fire treatment is possible.

APPROACH: Small, low-intensity fires will be conducted over a range of burning conditions in standing timber. The study will involve the analysis of fuel conditions before and after burning. Changes in fuel concentrations will be linked to such characterizations of the fires as fire reaction intensity, rate of spread and temperature levels at various strata (litter, duff and soil). Dispersal of smoke from small fires is dependent upon the atmosphere from ground level to 5,000 feet above terrain. Characterization of this atmospheric profile will be determined with a 'Cricket' rocket dropsonde. Radiosonde soundings in conjunction with synoptic weather data will provide further information. Incorporating the information into a forest model will aid forest managers in predicting a set of responses from a pre-fire examination.

PROGRESS: The data collection phase, analysis, and publications for this project are complete. This effort resulted in the devlopment of a prescription for burning which will produce: desired fuel reduction, minimum damage to standing timber, adequate smoke dispersal, and a minimum loss of biologically important soil nutrients. Successful burning occurred when twig sized fuels ranged in moisture content from 10 percent to 30 percent and wind velocities were under ten miles per hour. A mathematical winds direction model correlated well with actual wind direction and velocity.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Montana

5.0047, FOREST PROBLEM ANALYSES

P.E. BRUNS, Univ. of New Hampshire, Inst. of Nat. & Environ. Rsou., *Durham, New Hampshire* 03824 (0065049; NH00225-S)

OBJECTIVE: Undertake a problem analysis for determining the market structure and systems resulting from the total products and amenities of forested lands. Accomplish a problem analysis of how to effectively monitor the condition of, changes occurring in, and pressures from, alternative uses of forest land on an ongoing basis.

APPROACH: Literature, data banks and secondary data sources will be surveyed to assess the needs and researchable problems in forest marketing and forest land monitoring.

PROGRESS: The major results are the development of two research projects which are now in progess: NH 0012-M Evaluating Non-priced Forest Services and Amenities for Decision Making on Public Forest Lands; NH 00232-S Remote Sensing Applications to Land Use and Natural Resources in New Hampshire.

SUPPORTED BY New Hampshire State Government

5.0048, HIGH-RESOLUTION ATMOSPHERIC TRANSMITTANCE STUDY 13746-GS

R.L. ARMSTRONG, New Mexico State University, School of Arts & Sciences, *Las Cruces, New Mexico* 88001 (DA0F8997; DAAG29 77 G0127)

To conduct a high-resolution spectral study of the nu sub 2 fundamental of CO sub 2 at 15 microns emphasizing the q-branch profiles. relevance. Broadband transmission is important in the design and operation of laser-aided night vision devices, meteorological satellite-borne infrared radiometers used to obtain atmospheric temperature profiles, and instrumentation for pollution monitoring.

An infrared tunable semiconductor diode laser source will be used to obtain experimental spectral profiles of the gas in a multipass white cell. Spectra taken under different conditions of temperature and pressure will be used to assess the importance of the different broadening and correlation effects. Complementary theoretical research will involve computer generation of theoretical line shape profiles as a function of both temperature and pressure.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park NC 27709

SUPPORTED BY U.S. Dept. of Defense, Army

5.0049, THUNDERSTORM ELECTRICITY

M. BROOK, New Mexico Inst. Min. & Tech., Graduate School, *Socorro, New Mexico* 87801 (ATM76-14917 A01)

This effort will continue research into the cloud physics and electrical properties of thunderstorms. It involves the operation of a multistation lightning charge-location network in conjunction with fast-scanning radar observations of storms to further understanding of the relationships between precipitation and lightning and thunderstorm electrification mechanisms. Investigations will continue on the use of wideband, coherent radar techniques for direct determination of precipitation size and/or type, and for speeding up Doppler measurements of clouds. Laboratory studies of microwave backscatter from drops in orthogonal polarizations, and of the effect of electric fields upon droplet evaporation rates, will be continued. Experimental studies of the radar return from lightning for the study of lightning channels in clouds will be initiated.

The program will participate in the cooperative thunderstorm program at Kennedy Space Center for the summers of 1976 and 1977.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0050, TORNADO MEASUREMENTS

S.A. COLGATE, New Mexico Inst. Min. & Tech., Graduate School, *Socorro, New Mexico* 87801 (ATM76-82562)

The objective of this research is the testing of small instrumented rockets fired from a slow-flying aircraft to make measurements in water spouts and potentially tornadoes. The rockets will measure pressure, temperature, magnetic field ionization and electric field with 2.5 meter spacial resolution. The capabilities have already been demonstrated of firing small rockets of 350 grams mass, speed Mach 1.5, accuracy plus or minus .02 radians with adequate receiver telemetry signals strength at 6 kilometers from a slow-flight STOL equipped Cessna 210 G. Initially, an extensive calibration and flight testing will be performed in Florida using water spouts as targets. If these are successful, an attempt will be made to investigate tornado targets with the aircraft operation in Oklahoma, Texas and Kansas.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0051, CLOUD PHYSICS INSTRUMENTATION FOR MEASUREMENTS IN THUNDERCLOUDS

C.B. MOORE, New Mexico Inst. Min. & Tech., Graduate School, *Socorro, New Mexico* 87801 (ATM77-11689)

Measurements of the cloud and precipitation particle properties within thunderclouds are needed to support the concerted summer studies of electrified clouds that are under way at Kennedy Space Center. At present, no suitable probe of thunderclouds exists for simultaneous measurements of cloud particles and for the electrical charges that they carry. For this reason, adequate knowledge of the conditions and processes within electrified clouds is lacking; no theory of the observed, close interrelation of precipitation and cloud electrification has been generally accepted.

The New Mexico Institute of Mining and Technology operates a low-speed, powered sailplane that has been instrumented for penetrations and measurements of thunderclouds. This will augment the aircraft's electrical sensors with cloud physics instrumentation and with improved telemetry. The aircraft then will be used to determine the roles of the precipitation in the electrification of clouds and those of cloud electrification on the development of precipitation. Research will also investigate whether or not ice is necessary for significant cloud electrification.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0052, ANALYSIS OF SEVERE STORMS USING DIGITAL RADAR DATA

G.L. HUEBNER, Texas A & M University System, School of Geosciences, *College Station, Texas* 77843 (DF046420; AF-AFOSR-3146-77)

AF function - the Air Weather Service has the responsibility to provide timely and accurate meteorological forecasts to AF operations. Objective - to improve the present structural model of a severe storm under which large hail and tornadoes occur. Contribution - will provide the basic data to improve the AWS forecasting capability to predict severe storms.

New digital radar data from severe storms will be analyzed to determine: 1. The vertical distribution of the liquid-water content, 2. the layer of the atmosphere when the vertical development is taking place, 3. The location where tornadoes appear in the storm, and 4. the distribution of large hail. These data provide the data to improve the dynamics and physical models of the storms.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NP Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0053, AURORAL INFRARED MODELING

R.D. HARRIS, Utah Higher Education System, Center for Res. in Aeronomy, *Logan, Utah* 84321 (ATM75-19200 A01)

This grant funds as a supplement work to develop a theoretical model for infrared radiative transfer processes in the Earth's atmosphere including the effects of diffusion. This also funds analysis of a body of auroral rocket data for improvements of the model. The original grant (ATM-7519200) funded a radiative transfer model without diffusion, and without the analysis of the rocket data. This supplement will enhance considerably the usefulness and applicability of the model.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0054, A STUDY OF ION DYNAMICS AND RELATED EFFECTS AT MIDDLE AND HIGH LATITUDES

J. ST. MAURICE, Utah Higher Education System, Center for Res. in Aeronomy, *Logan, Utah* 84321 (ATM76-82323)

This grant funds a theoretical and data-analysis study of ion dynamics and related effects at middle and high latitudes. In particular, it funds: 1. continuation of a study of non-Maxwellian ion velocity distributions in regions of fast ion convection at high latitudes, with emphasis on the effects of these non-Maxwellian distributions on measurements. Measurements to be analyzed include retarding potential analyzers and incoherent scatter radar. 2. a study of the dynamics and chemistry of fast convecting regions in the auroral ionosphere, using data from the Atmosphere Explorer satellites, and 3. a study of chemical reaction rates, to determine how to interpret laboratory measurements of reaction rates for application to the ionosphere when non-Maxwellian velocity distributions are involved.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0055, CLOUD POPULATIONS AND THEIR INTERACTION WITH THE BOUNDARY LAYER DURING GARP ATLANTIC TROPICAL EXPERIMENT (GATE)

M. GARSTANG, Univ. of Virginia, School of Arts & Sciences, *Charlottesville, Virginia* 22903 (ATM74-21701 A04)

This project continues to deal with the analysis of specific parts of the GARP Atlantic Tropical Experiment (GATE) data and provides essential components of the overall objectives of the experiment. Two areas are selected for analysis: (a) the subcloud and lower cloud layer; (b) the cloud layer. In each, the objective is first to establish structure and second to examine interaction. Structure and interaction are examined in terms of scales of convective organization, with both the analysis and the interpretation being unified by the development of a common classification scheme. The proposed work is further conceived upon the principle that the analysis program will be closely coordinated with many other national and international groups. Subcloud and lower cloud layer observations obtained aboard the B-scale ships and cloud photography from ships and aircraft form the basic input. Products of the research are carefully designed to provide a foundation for a substantial part of the GATE analysis program with particular emphasis on interaction with numerical modeling.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0056, AIRBORNE STUDIES OF AN ACTIVE VOLCANO IN ALASKA

P.V. HOBBS, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (EAR76-15392 A02)

The eruption of St. Augustine, which began on 24 January 1976, presents an unusual opportunity to sample both the gaseous and particulate products of an andesitic volcano, one that is located along an active plate boundary.

Last year the Cloud Physics Research Group at the University of Washington instrumented an aircraft for taking such measurements, and monitored with it the 1975 eruption of Mt. Baker in Oregon. The results were impressive. The facility has been kept intact and ready for use on St. Augustine.

Specifically, the project will sample the eruptive plume for particulates with sizes of 0.003 to 100 microns, gases (especially sulfur, ozone and nitrogen oxides), droplets, electric fields, and meteorological parameters. Comparison with ground-based measurements in the Mt. Baker area indicates that sampling with the aircraft gives a much better picture of average composition and total content of the fine eruptive products.

SUPPORTED BY U.S. National Science Foundation, Div. of Earth Sciences

5.0057, VERTICAL MASS TRANSPORTS IN GATE CLOUD CLUSTERS FROM GEOSTATIONARY SATELLITE DATA

D. SUCHMAN, Univ. of Wisconsin, Space Science & Engr. Center, *Madison, Wisconsin* 53706 (TM76-16892 A01)

The objective of this supplement is to provide funds to the University of Wisconsin to engage in a joint program involving the University of Quebec, McGill University and the National Center for Atmospheric Research (NCAR).

The existing grant to which this is a supplement emphasizes the study of the mass circulation of cloud clusters and their environment. This supplement emphasizes convective organization and mass circulation internal to the clusters.

Funds are provided only for the University of Wisconsin effort in this joint research project.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0058, MAN-COMPUTER INTERACTIVE DATA SYSTEM (MCIDAS)

V. SUOMI, Univ. of Wisconsin, School of Natural Sciences, *Madison, Wisconsin* 53706 (DF241540; F19628-76-C-0035)

AF function - to improve the application of meteorological satellite data to weather analysis and forecasting. Deficiency - present methods of extracting information from satellite data are inadequate in speed and accuracy. Development - MCIDAS is an interactive satellite data processing system that permits a man and a computer system to interact with each other while preserving the benefits of human judgment and computer speed and accuracy. How development contributes - by overcoming the obstacle between judgment and speed in the processing of satellite data, computer techniques for analyzing and processing data can be developed with improved precision. The contractor will provide and test modifications to the system which will make the AFCRL and Univ. of Wisconsin systems completely compatible. The completed system will be tested, operating instruction and copies of all programs given to AFCRL personnel.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LY, L G Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, PREPARATION OF GUINEA PIG MACROPHAGES FOR ELECTROPHORETIC EXPERIMENTS IN SPACE

J. SAVAGE, Alabama Agric. & Mech. Univ., School of Arts & Sciences, *Normal*, *Alabama* 35762 (NSG 8042)

The objective of the proposed research was to design methods of culturing, storing and handling macrophage cells during space flight experiments. This report contains experimental data on the storage of macrophages after subjecting them to a variety of physical preservation conditions. The results showed that freezing and thawing immediately after extraction did not cause a change in the viability or electrophoretic mobility of the macrophage cells. However, prolonged storage at -80 degrees C did cause cell damage as indicated by a 95% reduction in viable cells. Cell damage was decreased when Glycerol or Dimethyl Sulphoxide (DMSO) was used as cryogenic protective agent. Glycerol was more effective at low concentrations and DMSO at higher concentrations.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0002, SPACE PROCESSING OF BIOLOGICAL MATERIALS

W.L. GIBSON, Alabama Agric. & Mech. Univ., School of Arts & Sciences, *Normal*, *Alabama* 35762 (NSG 8051)

OBJECTIVES: The project is a two-phase endeavor. The first phase involves maintenance and cultivation of tissue cultures under space flight conditions. 1. To optimize conditions for the growth of cell lines under simulated accelerated gravity forces and under simulated zero G (water buoyancy). 2. To develop methods for miniaturizing and automating the packaging of cell lines for space flight.

APPROACH: Four cell lines are being cultivated routinely and will be subjected to 3G forces in a suspension culture within a refrigerated centrifuge. Zero G will be simulated by using water buoyancy. Shake, static, suspension cultures and monolayers will be employed to optimize growth conditions. Progress has been made in routinely maintaining cells for use in this experimentation.

The second phase involves the extraction and purification of natural insecticides from plant by-products.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0003, SPACE PROCESSING OF BIOLOGICAL MATERIAL

W.L. GIBSON, Alabama Agric. & Mech. Univ., School of Arts & Sciences, *Normal*, *Alabama* 35762 (NSG 8051)

OBJECTIVES: 1. To extract and isolate plant components of marigolds and chrysanthemums, which demonstrate natural insecticidal properties. 2. To purify by column chromatography and electrophores the active insecticidal ingredients.

APPROACH: Marigolds and chrysanthemums have been grown during the summer and are now being harvested. Hexane extractions are being made of the stems, leaves, and roots. Alcohol distillation is being employed for the flowers. Electrophoretic techniques will be primarily employed for further purification following the removal of the waxy components by column chromatography.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0004, BIO-GAS PRODUCTION FROM ALLIGATOR WEEDS

A. LATIF, Alcorn State University, Undergraduate School, *Lorman*, *Mississippi* 39096 (NSG 8036)

Bio-gas and methane production from the microbial anaerobic decomposition of alligator weeds (Alternanthera philoxerides) (Mart.) Griesb., was investigated. These experiments demonstrated the ability of alligator weeds to produce an average of 7.5 ml of methane gas per gram of wet plant weight. The study revealed that sample preparation, light intensity, addition of reducing agents and other additives had no significant effect on bio-gas and/or methane production. Increasing initial pH of the liquid content of the fermentation unit increased bio-gas and methane production significantly. Raising incubation temperature from 24 degrees C to 35 degrees C, increased bio-gas and methane production but reduced the time lag between the production of bio-gas and production of methane gas. After the gas production ceased, the accumulated sludge in each fermentation unit was throughly shaken and the liquid content was used for bacterial enumeration, isolation and characterization. This work is still in progress. The result of this study will be reported in the annual report.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0005, BIOCHEMICAL AND STRUCTURAL STUDIES ON THE THERMAL RESISTANCE OF HARDY BACTERIAL SPORES

A.J. ANDREOLI, Calif. State Univ. & Colleges, School of Letters & Science, *Los Angeles*, *California* 90032 (NSG 2199)

A major contributor to the thermal resistant microbial contaminants of the lander portions of the Viking Planetary Probes was the presence of a population of soil bacteria which produce 'Hardy' spores, with high and unexpected thermal resistance. Much is known about the biochemical character and structure of conventional bacterial spores, but little as to how these contribute to thermal resistance. A biochemical and structural comparison of forepores (early development) and mother-cell components of 'Hardy' and conventional bacterial strains at specific and sequential stages of development, is now in progress. We have shown this approach to be productive in earlier studies. Briefly, our current findings show that 'Hardy' strains H13 and T8-8, 1) Grow readily and sporulate efficiently in complex and more restrictive media, 2) Grow initially at the expense of glycolysis, 3) Cell shift metabolically to respiration with the derepression of tricarboxylic acid cycle enzymes, 4) Sporulate with the same high degree of synchrony and a similar sequence of morphogenetic events evident in B. cereus, 5) Proceed through sporulation at a similar rate and 6) Show a greater capacity to synthesize and accumulate dipicolinic acid than B. cereus, when grown on complex media.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0006, BINDING INTERACTIONS OF 5' NUCLEOTIDES WITH AMINO ACIDS

J.B. ORENBERG, Calif. State Univ. & Colleges, School of Natural Sciences, *San Francisco*, *California* 94132 (NCA 2-660701)

The objective of this research proposal is the uncovering of experimental evidence for direct interactions between 5'-nucleotides (a nucleic acid component) and amino acids. The study of these interactions is necessary to an understanding of the chemical pathways leading to the origin of life and for elucidation of the origin of specific recognition of nucleic acids by enzymes and proteins. It is proposed in this study to investigate the magnitude of binding and the locus(i) of binding to 5'-nucleotides of selected non-aromatic amino acids, and substituted tyrosine and tryptophan derivatives. All of the proposed experiments will be studied using ultraviolet difference spectroscopy to evaluate the magnitude of the binding interaction, and proton, carbon-13, and phosphorus-31 nuclear magnetic resonance spectroscopy to determine the site(s) of binding interaction. The end product of these endeavors will be a written final report and publication of the results in the scientific literature.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0007, CHRONIC STRESS, ETHANOL, AND TESTICULAR FUNCTION

R. KAKIHANA, Calif. State Univ. & Colleges, School of Natural Sciences, *San Francisco, California* 94132 (NSG 2281)

The chronic administration of ethanol in man and laboratory animals results in the suppression of the pituitary-adrenocortical systems, presenting a physiological pattern similar to that observed in chronic stress. The chronic administration of ethanol likewise suppresses the pituitary-gonadal system, the extreme examples of which are hypogonadism and feminization frequently observed in chronic male alcoholics. The overall objective of the present proposal is to investigate the mechanisms involved in the suppression of the endocrine systems by chronic administration of the drug. A point of view is adopted here that drug addiction in neuroendocrine terms is viewed as a state of chronic physiological stress.

The following series of experiments will be carried out to determine the effect of chronic ethanol administration on the brain and plasma corticosterone and the plasma testosterone, luteinizing hormone (LH) and prolactin in rats treated with ethanol chronically. The brain and plasma corticosterone will be assayed by competitive protein binding assay and testosterone, LH and prolactin by radioimmunoassay. First, the changes of the circadian rhythms of these hormones will be studied during the course of the chronic ethanol administration. Secondly, the studies will be carried out to elucidate the effect of hyperactivity of the adrenocortical system on the testicular function. Thirdly, the present proposal attempts to study the characteristics of the ACTH feedback system during chronic stress when glucocorticoid elevation occurs hours or days at a time, as seen in chronic drug intoxication or chronic physiological stress.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0008, PERCEPTION AND PERFORMANCE IN FLIGHT SIMULATION - THE CONTRIBUTION OF VESTIBULAR, VISUAL, AND AUDITORY INFORMATION

B. CLARK, Calif. State Univ. & Colleges, Graduate School, *San Jose, California* 95114 (NSG 2269)

The purpose of the experiments outlined in this proposal is to elucidate perceptual factors which are important in the performance of tasks in simulated flight. It is proposed to study information processing involving vestibular, visual, and auditory systems with experiments in the following four specific areas: 1. Vestibular-visual interactions, 2. Visual perception: Complex imagery and reduced visibility simulation, 3. Auditory cues in simulated flight tasks, and 4. Man-cockpit information interfacing in flight management systems.

The proposed experiments envisage the use of the Ames Man-Carrying Rotation Device and fixed-base simulators at Ames Research Center to present pilots with vestibular, visual, and auditory information and determine the nature of perceptual factors in the performance of tasks similar to those found in flight and simulated flight. The objective is to identify perceptual factors which will facilitate the processing of information in flight simulators.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0009, A UNIFIED SYSTEM FOR THE BIOLOGICAL EXPLORATION OF MARS

R.C. BALLARD, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NSG 2213)

Data from the Viking 1975 Mars mission have been reviewed and analyzed. Although no direct evidence of life was observed, the results do not necessarily exclude the possibility of the existence of life since one cannot unquestionably state what constitutes living matter. The purpose of this research project was to expand, refine, and carefully evaluate a set of experiments intended to detect and characterize life on Mars. These experiments are a subset of the total potential biological and chemical analytical experiments that can be performed by the 'Unified Biology Instrument' in the biological exploration of Mars. This automated flight instrument, currently under development, uses a single mass spectrometer as the detector system to qualitatively and quantitatively analyze gases produced within a soil sample. Prior to the use of the mass spectrometer for analyses of Martian living systems, several basic scientific questions remained unanswered: (1) the minimal and maximal liquid phase necessary to facilitate response in a bacterial soil sample, (2) the detection limits of the mass spectrometer in the presence of a soil bacterial population, (3) the time period necessary to evaluate biological response, (4) the gases produced in response to various substrates, and (5) the gases produced in response to substrates in the absence of living systems. Using a mass spectrometer similar to the one being developed for Mars exploration, the first three questions have been approached and the results will be released in an early 1978 publication. The last two questions are presently being studied.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0010, A STUDY OF TOXIC EFFLUENTS OF THE POLYMER IN GENERAL & IDENTIFIED & UNIDENTIFIED COMPONENTS IN PARTICULAR

J.H. YOUNG, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NSG 2105)

The purpose of this study is to describe the determination of the relative toxicity of natural and synthetic polymers and composite products when they are burned.

A multiple biological probe and mini smoke test chamber (MSTC) technique for determination of relative toxicity of polymeric materials has been utilized. This unique approach not only gives valuable data to the relative toxicity but also elucidates the underlying mechanism of toxicity. A number of aircraft materials have been determined. The relative toxicity ranges from very toxic to fairly inert. The LC50 has a span from 7mg/L to 120 mg/L of the changes weight. Based on the LC50 values, a relative risk contingency for the aircraft materials has been assigned for each specific material. The values range from 2 to 217. A limiting value for the polymeric material has also been studied for specific material, should it be used in an aircraft. This limiting value is very useful for future polymeric materials that will be used in the aircraft. Certain samples have been studied in depth from both applied and academic point of view. Some very interesting aspects of toxicity with respect to the chromophore have been touched upon. They may have some important implications on the synthesis of less toxic polymers by simply conjugating the proper chromophore radical to the backbone of polymer molecules.

The current studies are concentrated in studying the toxic effects of solid particulates (smoke) from polymers which are subjected to pyrolysis.

The biological data generated from this study are the relative toxicity, performance index, acetylcholinesterase activity, and effect on the membrane potential. In addition there will be pathological assessment. As to the chemical data, there will be weighed changes of the pyrolyzed sample, char yield, condensed weight, effluent weight and total gas release. Some IR data will be generated from the gas.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0011, HISTAMINERGIC NEURAL PATHWAYS IN MAMMALIAN BRAIN

R. FOX, Calif. State Univ. & Colleges, School of Social Science, *San Jose, California* 95114 (NCA 2-675710)

Recent evidence indicating that histamine is a neurotransmitter in the central nervous system has produced a resurgence of interest in determining the functional role of brain histamine. This proposal is concerned with mapping the histaminergic pathway in the rat brain and determining the functional role of this transmitter. The pathway will be mapped by determining the effects of selected brain lesions on synaptosomal uptake and release of histamine. The general suspicion that histamine plays a modulatory role in the central nervous system will be directly evaluated at

the synaptic level by determining the effect of histamine on synaptosomal uptake and release of other transmitters. Finally, the suggestive evidence that histamine may be important in stress responses will be examined by measuring stress-produced changes in brain histamine.

Our findings will be submitted to the Consortium Office at the termination of the interchange agreements in a written report or as a reprint from published material.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0012, EFFECT OF SELECTED ATMOSPHERIC POLLUTANTS ON ANIMAL POPULATION SURROUNDING CLEVELAND, OHIO, ATMOSPHERIC TEST SITES

M.A. JOHNSON, Central State University, School of Arts & Sciences, *Wilberforce, Ohio* 45384 (NGR 36-033-003)

Sprague Dawley rats are being held in isolation chambers through which ambient air is flowing continuously. Measurements have been made to determine different concentrations of Cu, Zu, Pb, Mg, Fe, and Cd, in this air and their effect upon the rats. Rat colonies are housed in two of the city high schools in Cleveland, Ohio, and at Central State University. The rats are selectively bred, weighed weekly, and maintained on a Purina Lab Chow diet. Biopsies of hair, lungs, spleen, and blood samples have been collected for hematocrit and hemoglobin measurements. The animals have also been subjected to pulmonary lavage as well as the determination of reticulo-endothelial activity. The rats held in Cleveland, Ohio, have shown an increase in trace element concentrations in most of the tissues tested, as well as some alterations in lung clearance rates, hemotocrit values, and reticulo-endothelial activity as compared to those held at Central State University, in Wilberforce, Ohio.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0013, PROLONGED WEIGHTLESSNESS AND CARDIAC PERFORMANCE

L.N. COTHRAN, Howard University, School of Medicine, *Washington, District of Columbia* 20001 (NGL 09-011-017)

This research is designed to provide information concerning the effects of prolonged weightlessness on cardiovascular function. Particular emphasis has been placed upon cardiac performance. These studies envision a well-planned series of earthbound investigations on factors which modulate cardiac performance and an 'inflight' experiment within a 4-year period. The intent is to prepare for the study of cardiovascular function in small primates while they are orbiting the earth in a weightless state. A long-term space flight (300 plus days) is desired. This experiment is proposed at this time because it is essential to gain more information about the capacity of man for such long-term flight.

Our studies involve comparing the sensitivity of established invasive and noninvasive measurements of cardiac performance to both direct measurements of left apical acceleration and precordial acceleration as a means of assessing the value of these methods for detecting changes in myocardial contractility.

It is to be emphasized that this research is primarily designed to detect differences in, and to evaluate the pattern of behavior of, the heart and its control system in primates during prolonged space flight where these are compared to similar but earth-bound animals. By use of interventions of a certain predictable nature, we hope to define the net effect on cardiac performance, determine the reliability for producing essentially the same type of cardiac and vascular response when it is introduced periodically over time, and then use this now 'calibrated' intervention as a fairly precise 'forcing function' for studies on cardiac performance. If this can be done then we feel we can study primates during prolonged periods of preflight, space flight, reentry, and post flight. In the interim a systematic approach to the problem of gaining further knowledge about factors which modulate cardiac performance will be made.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0014, QUALITY ASSURANCE SYSTEM IN CLINICAL PRACTICE SETTINGS

P. CHANG, Howard University, School of Medicine, *Washington, District of Columbia* 20001 (NAS 5-23799)

This project is designed to test the versatility of the MIMS (Medical Information Management System) in retreiving the medical data collectively for analysis. We are asking the question 'are the patients getting the best quality of medical care at the minimal cost?' Two types of information are needed to examine the effectiveness and efficiency of the health care delivery system: (1) the data to provide the clinical manager the information of the volume of patient utilization, demographic characteristics of the utilizers, the appropriateness of the utilization, insurance data (or who finances the care?), the necessity of the X-ray and laboratory services ordered, etc. (2) the data to provide the physician or other providers an instant feedback information of their performance at the end of a patient's visit with regards to errors of omission and commission, data for clinical research, the outcome of patient care, pattern of medical referrals, unnecessary medications, etc.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0015, ZOOLOGICAL EFFECTS OF VARIATIONS IN ATMOSPHERIC OXYGEN LEVELS

G. KLOEK, Kentucky State University, Undergraduate School, *Frankfort, Kentucky* 40601 (NSG 801)

The effects on life of reduced-pressure, oxygen-enriched atmospheres are not fully understood. Supported by NASA Grant NGS-10-00801, Kentucky State University is examining the effects of these atmospheres on the fruit fly, Drosophila melanogaster. The project is based on three year's work with elevated oxygen concentrations at standard pressures. In these studies, mortality, fecundity, fertility and the selection of oxidative gene-enzymes were examined. Based on our findings and those of the Ames Research Center, NASA, Moffett Field, California, we know that while pure oxygen at 250 torr is toxic, tensions as great as 300 torr can be tolerated with no known side effects if a partial pressure of about 500 torr nitrogen is mixed with oxygen. It is now our plan to examine the effects of an atmosphere of 150 torr oxygen and 100 torr nitrogen (250 torr total pressure). Subsequently, we will modify the relative proportions of these gases and/or the total pressure. We hope to establish the long-range effects of oxygen enrichment, reduction of diluent gas pressures and the effects of total pressure reduction. The project receives generous and highly skilled technical assistance from Support Laboratory Four, Kennedy Space Center. John Gayle and Joe Morrison and their co-workers have been vital to the project.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0016, INVESTIGATION OF MEDICAL INFORMATION MANAGEMENT SYSTEM APPLICATION IN A COMPLEX HEALTH CARE FACILITY

R.S. ANDERSON, Meharry Medical College, School of Medicine, *Nashville, Tennessee* 37208 (NAS 5-23801)

OBJECTIVES: To utilize a cost-effective computer-based medical records system in a diversified health care delivery environment, including both in-patient and out-patient facilities.

APPROACH: The system is developed from a modified version of MIMS (Medical Information Management System) which was initially developed at NASA-Houston to monitor the health status of astronauts. One element of the health care service facilities will be used as a test area to evaluate the systems operation; after the introduction of modifications arising from the test results, the system will be extended to cover additional service areas.

CURRENT OPERATIONS: The original set of programs were written exclusively for CDC computers. Modification of the programs is being undertaken by staff on this and related contracts, to allow a wider use of the basic systems approach. This will be achieved by writing the programs in a form which is largely machine independent, with a significant degree of optimization to the data base actually in use. Medical Records data is currently being transcribed to computer files in preparation for system testing.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0017, ANALYTICAL MODEL FOR THE DYNAMIC STRESS AND DEFORMATION STUDIES IN THE LEFT VENTRICLE

G. RAY, Southern Univ. A & M College, School of Engineering, *Baton Rouge, Louisiana* 70813 (NSG 2041)

A finite-element, 3-dimensional dynamic model for human left ventricle in diastole has been constructed. This model uses cineangiographic data of left ventricular deformation and predicts the elastic stiffness property distribution in the myocardium. Evidence has been obtained indicating gross change of myocardial elastic stiffness in pathological (infarcted) tissue.

This computer model in conjunction with the cineangiogram offers a non-invasive means to evaluate the mechanical function of human left ventricle.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0018, THE INFLUENCE OF ENDOGENOUS AMINES ON THE DIURNAL TOXICITY OF CNS STIMULANTS AND DEPRESSANTS

C.A. WALKER, State University of Fla. Sys., School of Pharmacy, *Tallahassee, Florida* 32307 (NSG 2029)

This study will continue the identification and investigation of drugs (central nervous system (CNS) stimulants and depressants) in terms of significant circadian variations in toxicity (LD50) and therapeutic effectiveness (ED50). The effects of these drugs on brain amines at different times of the day will be extensively examined. Previous studies from our laboratory have shown biological rhythms for amines and/or neurotransmitter substances and how specific drugs such as amphetamines, cholinergics, anticholinergics, barbiturates, sedatives, epileptic and anti-epileptic responses are modified based on the time of day. The compounds to be measured will be expanded to histamine, GABA and cyclic AMP. Attempts will be made to complete a circadian profile simultaneously for epinephrine, norepinephrine, acetylcholine, serotonin, histamine, GABA and cyclic AMP for cortex, midbrain, caudate nucleus and cerebellum brain parts. Alterations in environmental parameters to include reverse cycles, uneven length of light-dark cycles and time periods for light-dark adaptations will be initiated in this investigation. Small laboratory animals will be used (mice and rats) initially, followed by larger animals when studying the therapeutic effectiveness of specific drugs. The animals will be adapted in the regular manner in a temperature-controlled environmental room equipped for automatic programmed illumination cycles.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0019, REGULATION OF THE ADRENAL CORTEX FUNCTION UNDER STRESS

K.F. SOLIMAN, State University of Fla. Sys., School of Pharmacy, *Tallahassee, Florida* 32307 (NSG 2183)

This research is designed to study the function of the adrenal gland in the rat during stress. Under stressful conditions the corticosteroid feedback control of ACTH release is not well defined. The regulation of ACTH was suggested to be mediated by brain neurotransmitters, and the role of glucocorticoid binding has not been fully investigated. During stress, alteration in brain uptake of glucocorticoids might be a possible means of modifying the adrenal-brain feedback regulation. In the proposed project, three different phases of experimentation will be undertaken. The first phase includes establishment of the circadian rhythm behavior of both brain amines and glucocorticoids, under normal conditions and under chronic and acute stressful conditions. The second phase includes the study of the pharmacokinetics of glucocorticoid binding under normal and stress conditions. The third phase includes brain uptake and binding under different experimental conditions. In the outlined experiments brain biogenic amines will be evaluated, adrenal function will be measured and stress effect on those parameters will be studied. It is hoped that this investigation will explain some of the complex relationships between the brain neurotransmitters and adrenal function.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0020, ELECTRON MICROSCOPY AND RADIATION STUDIES ON LAMPBRUSH CHROMOSOMES, AND MORPHOMETRICS OF CELLULAR DAMAGE IN IR-RADIATED MICE (ABBREV)

W.J. SAPP, Tuskegee Institute, Graduate School, *Tuskegee Institute, Alabama* 36088 (NCA 2-810701)

One of the projects involves the study of isolated chromosomes with the Scanning (SEM) and Transmission (TEM) electron microscopes. An additional area of experimentation with the isolated chromosomes systems is the test whether they can be used as a radiation dosimeter for DNA damage. The main objective of this research is to better understand the molecular organization and architecture of chromosomes. The techniques and end results of this work will be written in a report suitable for publication.

The second area of activity for this interchange would involve the participation of the proposer in a project underway in the Ultrastructural Research laboratory at Ames. The major interest in this work is the study of the effects of whole-body irradiation on various organs in mice. Electron microscopy in such research involves the preparation and examination of a large number of samples. The proposer would then assist the staff at Ames in the examination and interpretation of irradiated tissue to determine which organs are more susceptible to irradiation and to quantitate cellular response to the number of particles passing through the cell.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0021, STUDIES OF MICROWAVE RADIATION AS A TOOL IN SOIL STERILIZATION AGAINST MAJOR DISEASES AND PESTS OF AGRICULTURAL CROPS

J.G. WUTOH, Univ. of Maryland, Undergraduate School, *Princess Anne, Maryland* 21853 (NSG 6006)

Soil samples from different soil types and locations were analyzed for soil microorganisms and arthropods before and after exposure to 2450MHz, 60KW fully conveyorized microwave source. The effect of the microwave radiation on the soil organisms was assessed using the classical microbiological method, and the Dry-Funnel method for extraction of small arthropods developed by K.E. Fletcher of the Rothamsted Experiment Station at Harpenden, England. The project is still continuing but current results indicate that: (1) all fungi were detected after treatment; (2) all bacteria except spore-forming types were killed; (3) all nitrogen-fixing bacteria were inactivated and killed; (4) no nematodes survived the microwave treatment; (5) all isolated arthropods (eggs, larvae and adults) were found killed by the microwave treatment; (6) there did not appear to be any residual effects of the microwaves; (7) the effect of the microwave on the soil organisms was non-selective; (8) there appeared to be a correlation between moisture loss, and increase in soil temperature and the associated mortality of the organisms; (9) seed germination and growth of soybeans was excellent in soil after 6 minutes soil exposure but both germination and growth were retarded after 10 minutes soil exposure. The effect was probably due to a change in soil structure and compactability caused by breakdown of organic matter.

FUTURE PLANS: 1. Chemical analysis will be done on soils from all 12 sites before and after a 20-minute microwave exposure. 2. Growth studies of soybeans and peanuts in microwave-sterilized soil will be continued. The studies are being carried out in sterile gnotobiotic growth chambers.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0022, DETERMINATION OF SELECTED TOXIC METALS IN SEDIMENTS AND BENTHIC SPECIES IN RELATION TO NUCLEAR POWER PLANT OPERATIONS
H.L. PHELPS, Univ. of The Dist. of Columbia, Graduate School, *Washington, District of Columbia* 20005 (NGR 09-050-019)

Objectives of this research program include: 1) Sampling and analysis for copper, cadmium, zinc and lead in sediments and selected benthic species around the Calvert Cliffs Nuclear Power Plant on the Chesapeake Bay to determine the power plant impact; 2) Research on the effects of sorption of cadmium and copper by sediment and sediment components (humic acids, clay, protein, and chloride ion) on metal uptake in clams; 3) Research on the effects of chlorine on the desorption of cadmium and copper from sediment and sediment components. Statistical comparison of copper and zinc in oysters from the power plant site in pre- and post-operational periods as well as from a control site has shown increased copper levels and loss of copper/zinc correlation as a result of plant activities. Metal uptake studies were conducted with radioactive cadmium and copper sorbed to sediment and sediment components and showed that cadmium chloride was the form most rapidly accumulated by clams. Chlorination of sediment-sorbed radioactive cadmium and copper at chlorine levels similar to those used by power plants caused partial release of the metals. Plans are to continue sampling and analysis for toxic heavy metals in sediments and benthic species at the Calvert Cliffs Nuclear Power Plant site and to include the Chalk Point Steam Electric Station site on the Patuxent estuary. Sufficient samples will be taken to make a statistical comparison between the impact of the nuclear, once-pass cooling system at Calvert Cliffs with the nonnuclear, partial cooling tower system at Chalk Point.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0023, GLUCONEOGENESIS AND GLYCOGENOLYSIS - THE 24-HOUR PATTERN AND CORRELATION OF SEVERAL PHYSIOLOGIC FUNCTIONS
P.U. ASHMAN, Xavier University of Louisiana, Graduate School, *New Orleans, Louisiana* 70125 (NGR 19-007-004)

This investigation concerns the metabolic pathways of hepatic gluconeogenesis and glycogenolysis in laboratory rats. The purpose of this study is to correlate with each other and with the circadian locomotor activities of rats, the 24-hour patterns of certain tissue constituents such as liver glycogen, blood glucose, certain enzymes and the controlling factors involved in these two pathways. Rats are maintained in a photoperiod room under 12 hours of alternating light and dark. At the end of the experimental regimen, organs and tissues are harvested at 4-hour intervals throughout a 24-hour period. The tissue constituents are then assayed for possible diurnal variations. Significant diurnal variations were found for rat hepatic glucose-6-phosphatase (E.C. 3.1.3.9), neutral fructose 1,6-diphosphatase (E.C. 3.1.3.11, Ashman et at., 1976. Comp. Biochem. Physiol. 53B: 315-318), phosphohexose isomerase (E.C. 5.3.1.9), phosphoglucomutase (E.C. 2.7.5.1), liver glycogen, plasma glucose, plasma corticosterone and stomach (plus contents) weights. Correlations were made between circadian locomotor activities, plasma corticosterone, liver glycogen and the enzymes. Corticosterone levels peak immediately at the onset of darkness when the rats begin their running. When rats eat during the dark period, liver glycogen is stored until it reaches maximum levels during the light period. As the investigation progresses, additional correlations will be made.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0024, F-15 TRAINING SYSTEM EVALUATION (OT&E)
J.C. REED, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223370)

To support the operational test and evaluation (OT&E) of the F-15A flight simulator evaluating the operational effectiveness of system performance in student and continuation training and by evaluating system performance when operated and maintained by military personnel in the field.

(1) Instructors and students will subjectively assess the training effectiveness of the simulator. (2) A transfer of training study will be part of the late phases of the project. (3) Scoring algorithms will be validated by comparing instructor- and simulator-generated ratings of performance. (4) Questionnaires and interviews will be used to evaluate the utility and effectiveness of the instructional features of the system and the console. (5) An assessment of engineering fidelity will be made by comparing simulator response to available aircraft data and pilot judgements. (6) Maintenance and reliability will be closely monitored. (7) Cost data and estimates will be collected and analyzed for incorporation into life-cycle cost models. AFHRL/FT will provide consultative support in experimental design, methodology development, data collection monitoring, data analysis, and interpretation and reporting of the project results.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory FTO, Williams AFB, Arizona 85224

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0025, ISD APPLICATION STUDY
J.D. SMITH, Logicon Incorporated, *Torrance, California* 90503 (DF222790; F33615-77-C-0034)

To identify and document problem areas encountered in the application of ISD procedures to flying training programs and develop alternative plans for dealing with the problems so as to optimize implementation of Air Force ISD program.

This study will be conducted in five phases. In phase I the contractor will refine and add detail to the research plan developed in the proposal. In phase II the contractor will visit operational ISD units to collect data related to successes and problems in the application of ISD methodology. Phase III (synthesis and analysis) will include a review and analysis of ISD documentation, categorization of problems and successes, identification of common and uncommon problem areas across commands, and a full and clear description of the problem. Phase IV will develop an array of alternative plans for solving the problems identified during phase III. In phase V, the contractor will submit a technical report to the entire study project to include a revised report of alternative solutions.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory FTT, Williams AFB, Arizona 85224

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0026, DIVIDED ATTENTION AND TASK WORKLOAD IN CONTROL FAILURE DETECTION AND DECISION-MAKING IN AVIATION SYSTEMS
C.D. WICKENS, Univ. of Illinois, School of Liberal Arts & Sci., *Urbana, Illinois* 61801 (DF049320; AF-AFOSR-3380-77)

AF function - the role of attentional processes in flight control has assumed an increasingly important position in aviation and man-machine systems research because of increased complexity of weapon systems and aircraft missions. Deficiency - accordingly, it is critical to better define the pilot's attention capacities and limitations for purposes of enhancing the probability of mission effectiveness. Objective - attention allocation processes as they affect pilot operator performance under varying task loads and in relation to monitoring vs. control functions will be modeled to elucidate understanding of the interrelationships. How research contributes - a major contribution of the proposed research to real-world aviation problems is anticipated to be the provision of a theoretical basis for predicting the consequences of adding different operator requirements in the design of new systems.

Employing a latency-based theory of signal detection, the research will model the operator's performance in detecting and responding to changes (failures) in the dynamics of simulated aircraft systems. Performance as a function of operator monitoring

vs. operator controlling functions will be examined, and conclusions will be drawn concerning the appropriateness of one mode vs. the other. Also, the effects of divided attention on tracking performance using control theory analysis will be investigated and an attempt will be made to model the dynamic characteristics of attention allocation as the operator is required to respond to increasing or decreasing task demands in the dual task environment. Application of the results will be explored concerning (1) on-line monitoring of attention, and (2) attention allocation ability as a predictor of flight training success.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NL Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0027, JUDGMENT EVALUATION AND INSTRUCTION IN CIVIL PILOT TRAINING

UNKNOWN, Univ. of Illinois, Graduate School, *Urbana, Illinois* 61801 (FA77wa-3920; FA59872 (TRAIS NO.))

Tasks will be to: (1) define judgment fully with all its mental, moral, emotional, social, psychological, philosophical, and educational implications in terms of its application to the art of flying; (2) determine whether and how judgment, relating especially to pilot performance, can be imparted to a human subject; (3) outline experimental methods for imparting judgmental qualities and, sequentially, methods for evaluation in the field of pilot training, i.e., use of simulators, experimental training aircraft and psychological battery tests.

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary

6.0028, STUDENT INTERPRETATION OF LANDSAT IMAGERY

P.G. WHITE, Western Carolina University, Graduate School, *Cullowhee, North Carolina* 28723 (SER77-02356)

Western Carolina University plans to utilize national and selected international coverage of positive LANDSAT imagery, make paper prints for class use and train students in the use of the latest remote sensing techniques in mapping, statistical and areal analysis. The newly developed techniques will be useful in courses and work in planning, geomorphic studies, forest management, archaeological investigations and mineral, fuel and water resource investigations.

SUPPORTED BY U.S. National Science Foundation, Div. of Science Education Resources Improvement

6.0029, MODEL OF BIOMECHANICAL RESPONSE IN MOIFE

I. KALEPS, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321250)

This work unit is part of an effort whose end product will be a predictive model of pilot tracking performance in low-level, high-speed flight. Fundamental to achieving that goal is the construction of a biomechanical model of the feedthrough of vibration through the musculoskeletal system and into the aircraft system. That is the objective of this work unit. This modelling effort will also contribute to a related effort whose product will be a predictive model of visual performance in low-level, high-speed flight.

For the most part, the data needed for this modelling effort will be collected from vibration experiments conducted under work units 72310180 and 72310182. Fairly adequate models already exist for the feedthrough from the shoulder to the control stick. The major emphasis of this effort will be to model the transmission of vibration from the buttocks through the vertebral column to the shoulder and to the head.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0030, HEARING RISK DUE TO COMMUNICATION SIGNALS

R. MCKINLEY, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322960)

Effective voice communication in high-level noise environs may require air and ground crew personnel to increase the intensity of the signal to a level that is damaging to hearing. The objective of this effort is to measure ambient noise and voice communication signal levels under standard AF communication devices during a variety of air and ground operations, to quantify the hearing damage risk and to consider alternate operating procedures that eliminate such risk. This effort will benefit the SG, ASD, life support SPO, base bioenvironmental engineers, as well as air and ground crew effectiveness and safety.

The approach incorporates the field measurement of the acoustic signals under standard AF voice communication devices in a wide variety of air and ground operational environments. Measurements will utilize a precision miniature tape recorder and miniature microphone positioned at the ear under the communication devices. Data will be analyzed in the laboratory to identify operational situations with the risk potential, factors contributing to the problem and possible remedies.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0031, HUMAN ENGINEERING SUPPORT GO FBU-15

J.M. RING, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321010)

The GBU-15 (V)/B Modular Guided Weapon System is a family of weapons comprised of two distinctly different aerodynamic configurations, different guidance systems, autopilots, warheads, fuzes, and an optical data link. There are more than 28 different configurations involved, with the Air Force procuring the modules and assembling them according to the Theatre Commander's assessment of the demands of the operational situation. The main objective of this effort is to provide human engineering support to ensure that blue-suiters can assemble the weapons in any of the required configurations, test and checkout the resulting configurations, upload, operationally use the weapon, download if necessary, and maintain the modules. The entire program is scheduled through FY 82. ADTC/SD15 is providing travel funds for the AMRL human engineering team and contractual funds for an on-site human engineer under the monitorship of the AMRL team.

The effort is paced by the schedule and directives pertinent to the GBU-15 (V)/B system and the development of major modules and components which comprise the system. The approach is to review appropriate specifications, drawings, and hardware (where available) to ascertain that the operational user can efficiently and effectively build up, test and check, and operationally employ the weapon. Program reviews and design reviews are attended and comments and suggestions made for more efficient and effective human use. Consultation with any or all of the 10 or more contractors involved, with appropriate ADTC, TAC, SAC, AFLC, AFTEC, ASD and ATC cognizant personnel is a continuing requirement.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0032, EVALUATION OF BIODYNAMIC RESPONSE TO ESCAPE SYSTEM AND AIRCRAFT CRASH ENVIRONMENT

P.A. GRAF, Univ. of Dayton, Res. Inst., *Dayton, Ohio* 45409 (DF320280; F33615-76-C-0525)

The objectives are (1) to provide an efficient means for processing impact data collected on the various AMRL impact facilities as well as data collected by other governmental agencies for analysis by the AMRL, (2) to provide statistical analysis capability to support the design of impact experiments, (3) to provide a continuous error analysis program with respect to data collection and processing methods, and (4) to provide data in finished form to ultimately be used by AMRL investigators to establish system design criteria or to evaluate the effectiveness of existing systems.

Data handled under this program will be processed and analyzed using conventional techniques. New methods or modifications of existing techniques may be developed and recommended by the contractor to meet specific program requirements.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0033, HEAD IMPACT CRITERIA
N.S. PHILLIPS, Univ. of Dayton, School of Engineering, *Dayton, Ohio* 45409 (DF320650; F33615-77-C-0534)

Objectives are: (1) to provide methods to assess biomedical effects of direct impact of crewman's helmeted head, (2) to determine the influence of the USAF flight helmet on impact transmitted to head, (3) to determine head impact measuring techniques and (4) to develop method to simulate the crewman during bird impact tests of aircraft canopies. The ultimate goal is impact test and evaluation criteria for new aircraft windshields/canopies and flight helmets.

Canopy impact data from tests of F-16 and F-111 canopies will be analyzed, existing analytical models of aircraft canopy impact responses will be applied, the importance of crew position during impact will be evaluated. Analogs of the crewman's impact response and helmet dynamics will be used to assess canopy impact environments and they will be refined for aircraft canopy design evaluation applications, and impact tests of helmets will be done to determine their protection properties. Standards for aircraft canopy test and evaluation criteria will be developed.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0034, INVESTIGATION OF ADAPTIVE OBSERVERS FOR THE HUMAN OPERATOR IDENTIFICATION PROBLEM
B.K. COLBURN, Texas A & M University System, Graduate School, *College Station, Texas* 77843 (DF048260; AF-AFOSR-3295-77)

AF function - in the design of high-performance control systems, accurate models of the pilot dynamics are necessary to properly account for the pilot as a control element. Deficiency - pilot models can be used to perform stress tests which might be harmful or undesirable to subject humans to such as nuclear irradiation, hypoxia, severe acceleration due to extremes of aerial combat maneuvers, and responses due to temperature and vibration. Objective - the real-time identification problem as regards aircraft pilot modeling and parameter identification as currently under study by the USAF School of Aerospace Medicine will be examined. How research contributes - the research will enhance the development of on-line identification algorithms for identifying time-varying models, both linear and nonlinear. The resulting computer algorithms will be useful in obtaining accurate, reproducible pilot transfer function models which are of great importance in predicting accurate responses for human stress studies.

New identification approaches will be developed, and an investigation of the identification algorithms via computer simulation will be verified.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NL Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0035, AEROMEDICAL DESIGN AND ENGINEERING ANALYSIS
C.S. ACOSTA, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322120)

To provide aeromedical design and engineering support to major commands for biomedical systems developed by USAFSAM and accepted for operational use. Prepare instructions and maintenance information for equipment users, and prepare technical reports to document completed R&D efforts.

Prepare required acquisition documentation, monitor systems acquisition, provide operation and maintenance instructions to system users, assist in identifying and eliminating operational deficiencies, and prepare required USAFSAM technical reports upon completion of development efforts. This work was previously documented under work units 7755-15-01 and 7996-02-AA.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0036, LIMITS FOR OXYGEN CONCENTRATION IN AIRCREW BREATHING MIXTURES FOR FIGHTER AIRCRAFT
F.W. BAUMGARDNER, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322270)

Determine the range of oxygen concentrations in aircrew breathing mixtures that will prevent or retard the development of atelectasis during or after exposure to acceleration stress. Aircrew members breathing 100 percent oxygen during exposure to acceleration stress in high-performance aircraft have shown an increased incidence of symptoms of the aeroatelectasis syndrome which include retrosternal chest pain, difficulty in breathing, and a desire to cough. These have been attributed to alveolar collapse in the dependent regions of the lung, which is felt to be caused by the compression of the dependent lung fields by the combined effects of the acceleration stress and anti-g suit inflation and the rapid absorption of oxygen from these compressed alveoli. The presence of nitrogen in the inspired gas mixture has shown to retard the rapid absorption of oxygen from alveoli and thus prevent or retard the development of the syndrome. The combined effects of acceleration stress and breathing intermediate concentrations of oxygen have not previously been studied. Data obtained will serve as a basis for establishing criteria of maximum acceptable concentration of inspired oxygen to be utilized in high-performance aircraft aircrew breathing systems. This maximum acceptable concentration should be of sufficient magnitude to provide the advantages of an increased concentration of inspired oxygen required in the fighter aircraft environment.

Human volunteer subjects will be exposed to various levels of acceleration stress while inspiring gas mixtures containing various concentrations of oxygen and nitrogen. The responses of the respiratory system will be examined and analyzed to determine the degree of physiologic change imposed by these combined stresses. Data will include, but not be limited to, effects on pulmonary compliance, pulmonary resistance, tidal volume, frequency of breathing, and pulmonary ventilation.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0037, BIOMEDICAL CRITERIA FOR ADVANCED RESPIRATORY LIFE SUPPORT SYSTEMS
F.W. BAUMGARDNER, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322500)

The performance of breathing systems must insure adequate physiologic function to users in diverse operational environments. In dynamic operation current inventory regulators waste oxygen, exhibit flow limitation, and impose physiologically stressful breathing pressure on the cardiopulmonary system of the user. The primary objective of this work unit is to establish concepts and data for the development of systems which optimize oxygen delivery in advanced and conceptual aircraft. Additionally, selected parameters will be examined to identify appropriate ones which will indicate individual oxygen requirements under various flight profiles and degrees of stress and the feasibility of demand-supply, matching systems will be assessed. These efforts are coordinated with ASD/SML on a continual basis in accordance with letters of agreement, and close technical liaison is maintained with Oklahoma City ALC, ASD/ENCCE, NADC, and USAARL. Previous accomplishments in this area are documented under work unit 71641718. This work is being established to implement a new TPO as directed by HQ AMD.

Laboratory studies as well as informal reports from the operating commands have indicated that current military specifications for oxygen supply and delivery equipment do not adequately meet man's respiratory requirements in high-performance aircraft now being deployed. Efforts through FY 78 will be oriented toward providing ASD with standards for revising MIL-R-83178, specification of oxygen regulators, and MIL-V-27296, oxygen mask inhalation, exhalation valve. These efforts will include investigation of physiologic parameters such as in-

stantaneous ventilatory flow, ventilatory pressure, tidal volume, respiratory frequency, respiratory period, inspiratory and expiratory times, the time derivative of initial inspiratory pressure and flow, minute ventilation and oxygen consumption. The physiologic effects of current inventory equipment such as long hose between oxygen regulator amd mask will also be examined. Standards derived from physiologic studies will be reported to ADS/EN. A preliminary report on respiratory flow requirements and standards for revision of MIL-R-83178 covering the area of flow profiles under environmental stress conditions is projected for Dec 76.

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0038, EYE EFFECTS OF NUCLEAR DETONATIONS
N.E. LOF, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF318160)

Field tests and laboratory experiments have shown conclusively that flashblindness and retinal burns caused by a nuclear detonation can be hazardous to aircrews at far greater distances than other immediate nuclear weapon effects (blast, thermal, ionizing). The objective of this effort is to (1) apply existing knowledge and obtain required experimental flashblindness data for the S/V program, (2) provide predictions of nuclear flash eye safe separation distances, (3) evaluate the eye hazard associated with the use of high-intensity light sources in AF research and development projects, (4) calculate the eye protection required for safe viewing of high-intensity light sources, and (5) act as a consultant on flashblindness protective device requirements and development.

Existing prediction models and techniques will be tested against available experimental data and modified as necessary for adequacy and accuracy. Programs will be modified as necessary to furnish output in a format compatible with input requirements of S/V models. Experimental data, using humans and monkeys as subjects, will be obtained to determine flashblinded subjects' ability to control a flight simulator. Data obtained will be used in S/V modeling efforts. Generalized nuclear flash eye effects and protection requirements will be provided to using agencies in the form of technical reports. Predictions and consultation will be furnished to using agencies for specific situations upon request. Cognizance of new materials development will be maintained for possible use in flashblindness protective devices. Promising materials will be tested and evaluated and recommendations reported.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine RA, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0039, TEST AND EVALUATION SUPPORT TO ADTC AEROSPACE GROUND EQUIPMENT
R.E. RYAN, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF323350)

This effort provides expertise and instrumentation to determine the quality and build-up of exhaust gases in and around aerospace ground equipment (AGE) during DT&E at ADTC, Eglin AFB, FL. Human engineering/crew technology support to ADTC is coordinated with AMRL through AMD.

Trace gas analyzers capable of detecting carbon monoxide, nitric oxide, nitrogen dioxide, and hydrocarbons are used to measure exhaust gas concentrations in the most typical operating environments of age.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0040, USAF CENTRAL ECG LIBRARY
J.H. TRIEBWASSER, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322020)

Identify aircrew members having electrocardiographic abnormalities that are associated with potential risk in terms of sudden incapacitation/flying safety. Serve as a consultation service to the field in terms of interpretating and defining the significance of ECG findings, and the administrative aspects of the latter. Establish better criteria for the significance of specific electrocardiographic abnormalities in terms of aircrew selection and retention.

The routine review of the electrocardiograms on aircrew members and the consultation aspects of the USAF central ECG library are those outlined in AFR 160-43 and AFR 160-17. Long-term followup studies of specific electrocardiographic abnormalities will be conducted using questionnaires and the results of the medical evaluations within the Aeromedical Consultation Service. Methods for automating ECG interpretation, filing, and retrieval will be explored.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0041, DEVELOPMENT OF A CAPABILITY TO AUTOMATE AMBULATORY BLOOD PRESSURE RECORDINGS
R.L. WOLTHUIS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321680)

It is very difficult to differentiate between labile blood pressure elevations and fixed hypertension since blood pressure measurements cannot be made during routine daily activities. This effort will define the usefulness of ambulatory blood pressure measurements in identifying aircrew members who have significant hypertension and the effectiveness of drug therapy while on waiverable medications.

Two automated ambulatory blood pressure recorders have been manufactured and modified to this laboratory's specifications. This effort will define the reliability and accuracy of these recorders. The blood pressures recorded during routine ambulation will be correlated with the blood pressures obtained during orthostasis and exercise in normotensive and hypertensive aircrew members. This work was formerly documented under work unit 7755-01-05.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0042, CRITERIA FOR ABNORMAL ECG RESPONSE TO EXERCISE STRESS TESTING USING 3-DIMENSIONAL ANALYSIS OF ORTHOGONAL LEAD SYSTEMS
R. WOLTHUIS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321830)

Less than 50 percent of aircrew members subjected to coronary arteriography because of an abnormal electrocardiographic response to exercise stress testing have obstructive coronary artery disease. This effort will better define normal versus abnormal criteria of interpreting electrocardiographic responses to exercise stress testing using widely accepted orthogonal lead systems to establish a more reliable immediate risk identification of aircrew members with potential coronary artery disease.

Orthogonal electrocardiograms will be recorded during exercise stress testing and subjected to automated three-dimensional analyses. Results will be correlated with clinical evaluations including coronary arteriography and the cardiopulmonary responses to exercise stress testing. Noninvasive methods for evaluating the circulatory responses (e.g. echocardiography) and the effect of drugs (e.g. propranolol) on the repolarization response to exercise will be utilized and correlated with the results of left ventricular angiography and coronary arteriography. This work was formerly documented under 7755-01-05.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, EVALUATION OF DIGITAL SYSTEMS DESIGN LANGUAGES

S.G. SHIVA, Alabama Agric. & Mech. Univ., School of Technology, *Normal, Alabama* 35762 (NSG 8057)

Due to their great computational speed and simulation ability digital computers are being used extensively in designing and analyzing new digital systems. Several languages have been reported in literature to enable the digital system designer to describe the operation of the system.

Alabama A&M University will conduct an extensive literature survey to collect the available digital design languages and associated software. These languages will be evaluated with respect to their ease of use and implementation details. A complete design package will be assembled to aid the design activities at the Electronics and Control Laboratory of the Marshall Space Flight Center.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0002, HOLOGRAPHIC GRATINGS FOR SPECTROGRAPHIC APPLICATIONS - STUDY OF ABERRATIONS

M.S. BHATIA, Bowie State College, Graduate School, *Bowie, Maryland* 20715 (NGR 21-027-010)

The primary investigation is to carry out a detailed theoretical analysis of the optical aberrations of holographic gratings made on concave and convex surfaces for the purpose of the development of space qualified optical reflecting diffraction gratings possessing superior optical properties as compared to conventional gratings.

The objective of this project is to develop a technique to make space qualified optical reflection gratings using light interference phenomena. The optical reflecting gratings will exhibit optical/mechanical properties which, in the 2 nm to 5000 nm spectral region, are superior to mechanically ruled diffraction gratings. These gratings will have stigmatic imaging at selected wavelengths, a reduction of astigmatism throughout the spectral region of interest, very low stray radiation (a factor of 5 or better as compared to mechanically ruled gratings), improved efficiency, fast focal ratio for concave gratings, and elimination of ghosts (false emission line spectra due to the mechanical ruling process). Gratings will be made with groove frequencies greater than 3600 grooves/nm and ruled on practically any surface geometry. In addition, a detailed theoretical study of holographic gratings of various geometrical shapes will be pursued to determine the optimum performance of the gratings relative to the fabrication parameters.

As reported in the documents 0X-720-77-79 and X-720-77-145 computer programs have been developed for designing holographic gratings for Seya-Namioka type monochromators so as to (1) minimize abberrations over a desired wavelength range and (2) to correct aberrations at a specified wavelength. The program gives correct results for a given wavelength range and groove frequency of 600 lines per millimeter. However, for larger groove frequencies we have discovered that the upper wavelength limit must be chosen for each groove frequency so that the (1) discriminant of the equations involving the parameter A300 is positive and (2) the aberrations are minimized. By carrying out a mathematical analysis a suitable program will be developed which will assist in choosing an optimum value of A300. This program, used in conjunction with the program developed previously, will enable us to determine recording parameters at higher groove frequencies.

In addition, a mathematical analysis of the design of a toroid grating is being made. (Text abridged.)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0003, RESEARCH IN NUMERICAL INTEGRATION AND ATTITUDE CONTROL LAWS

S. SRIVASTAVA, Bowie State College, Graduate School, *Bowie, Maryland* 20715 (NGR 21-027-004)

The main objective of this task is to develop control laws for the various Multimission Modular Spacecrafts (MMS) missions. It is desired to compare as to accuracy and ease of computation the propagation of a quaternion state, to have a procedure to generate steady-state solution to the Kalman filter and to develop computational software for implementation of the best matrix of transformation from reference to a body coordinate system. A survey of attitude control systems has been carried out on the basis of available open literature.

In the second phase of the project the development of control laws for the various mission classes is planned. Computational software for implementation of the best matrix that maps two or more vectors from a reference to a body coordinate system, assuming the two representatives of the vectors are known. This problem has arisen in the estimation of the attitude of a satellite by using direction cosines (Vk) of objects in a known frame of reference. It is desired to have a procedure to generate steady-state solution to Kalman filter. In many applications the implementation of constant-gain filter is desired rather than an optimal filter. This constant-gain filter appears near optimal if the gain is chosen as the steady-state solution to the optimal filters. Further, comparison of accuracy and ease of a computation of the propagation of a quaternion state with the vector W given is a useful aspect of the attitude determination.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0004, DEVELOPMENT OF A WINTER WHEAT ADJUSTABLE CALENDAR MODEL

J.R. BAKER, Fort Lewis College, Undergraduate School, *Durango, Colorado* 81301 (NAS 9-15276)

Objective of the investigation is the development of algebraic functions relating winter wheat phenological growth stages to environmentally related independent variables (temperatures, daylength, precipitation, geographic location, etc.). Data from crop reporting districts in the Great Plains and Rocky Mountain regions are utilized in a generalized least squares technique to estimate parameters for various functional forms, in an attempt to identify the most appropriate equation forms. Preliminary results indicate that linear equation forms may be the most advantageous. Future investigations will concentrate on refinement of parameter estimates, investigations of alternate functional forms, and testing of the functional forms utilizing independent data sets.

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7.0005, IMPROVEMENTS IN DIGITAL OPTIMAL CONTROL OF NONLINEAR MULTIVARIABLE CONSTRAINED SYSTEMS

A. HARGROVE, Hampton Institute, Graduate School, *Hampton, Virginia* 23368 (NSG 1478)

This is an original study that will refine and improve the algorithm which already optimizes any nonlinear multivariable constrained system. The algorithm is to be independent of the initial state and is to be refined and improved in order to reduce computer running time and storage requirements. When completed the controller will be valuable in the design of aircraft control systems based on frequency response criteria. A particularly difficult system of nine nonlinear equations is chosen as a test problem.

The expected time span for the research is one year, beginning October 15, 1977, and ending October 14, 1978. Research will be conducted full time during the months of June, July, and August and part time during the other months.

All analysis, modeling and optimization will be done via digital computer. The NASA-Langley Research Center central computer will be used. A remote interactive teletype terminal will be installed for this research at Hampton Institute and connected by telephone line to the NASA computing facility.

Major tasks to be performed or investigated are: (1) Reduce excessive computer running time of the numerical analysis by improved programming. (2) Reduce excessive computer storage time now required of the numerical analysis by improved programming and combining certain matrices. (3) Compute on line

as part of the algorithm the following tasks now done off line: (a) Computing the initial state; (b) Referring the initial state; (c) Inverting the reactance matrix; (d) Testing the system for stability.

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7.0006, APPLICATION OF MEDICAL INFORMATION MANAGEMENT SYSTEM 'MIMS'
J.W. FRANKOWSKY, Lincoln University, Graduate School, *Lincoln University, Pennsylvania* 19352 (NAS 5-23800)

The Medical Information Management System ('MIMS') is a NASA-developed computerized system that will allow a hospital, laboratory, clinic or private physician to create and control a medical data base on patients. The system is interactive, has flexible format and provides the user with the ability to create records, recall records, search for specific data and do research with the data base created.

Current modifications of the system concentrate on adapting the system to small computers in order to increase prospective users. Conversion of programs from Super FORTRAN to Standard FORTRAN is about 95 percent complete.

Extensions of the systems are being made by developing diagnostic computer capability. This would allow entry of symptoms and objective physical findings as well as laboratory data and in turn receive from the computer reasonable diagnostic possibilities in order of descending probability.

The project necessitates close cooperation with selected physicians and medical facilities in order to: 1) design useful formats for the data, 2) decide what data to store, 3) test all parameters of the system and 4) obtain maximum benefit from the retrieval of the information.

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7.0007, APPLICATION OF MEDICAL INFORMATION MANAGEMENT SYSTEM (MIMS) FOR PROBLEM-ORIENTED MEDICAL RECORD KEEPING
T.E. NORRIS, Morehouse College, School of Arts & Sciences, *Atlanta, Georgia* 30314 (NAS 5-23571)

OBJECTIVE: The objective of this project is to automate the problem-oriented medical record keeping system at the School of Medicine at Morehouse College.

APPROACH: A problem-oriented record can be likened to a detective's file of clues in search of a resolution to a case. No detail, even if seemingly trivial, should be omitted but should be noted and tracked until it proves fruitless. It is clear that problem-oriented records tend to become very large due to this completeness. The problem for MIMS would be the design and arrangement of the record in an efficient and meaningful way. Thus, one part of the project is to support the automation of records that are in a problem-oriented format. To automate the medical records necessitates making some health personnel knowledgeable about automated systems and about MIMS in particular. The problem-oriented record used in this project is the 'Defined Database Form' which is operational at Grady Memorial Hospital (of Emory University School of Medicine.)

PROGRESS: To date, the following tasks have been accomplished: complete checkout of the MIMS system; assembly and evaluation of medical data, training program for School of Medicine personnel and the design of a plan to include MIMS in the curriculum of the School of Medicine at Morehouse College.

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7.0008, INVESTIGATIONS INTO AFFINE TRANSFORMATION ALGORITHMS FOR SIGNATURE EXTENSION
T.F. MCCABE, Pan Amer. University, Graduate School, *Edinburg, Texas* 78539 (NSG 9053)

Investigations into computational problems relating to LACIE are being conducted.

PROBLEM 1: A number of procedures used in LACIE are iterative in nature and, in most cases, a sequence of vectors (or matrices) is produced which converges to a theoretical answer. If the convergence is linear a technique to accelerate convergence has been derived. A theorem verifying the general applicability of the technique is proved.

PROBLEM 2: A least squares technique to approximate an affine transformation for signature extension using global scene statistics had been previously developed. A modified technique to incorporate each crop proportion into the model has been developed. Although variational equations to include proportions into the model are calculated, computer simulations indicate this technique offers no advantage (and in many cases is worse) than maximum likelihood methods.

PROBLEM 3: A small computer system is being developed to run on a DEC-10 computer which will allow a user to perform signature extension algorithms. Most algorithms were previously developed at NASA-JSC for UNIVAC or IBM computers.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0009, THEORETICAL MODEL FOR A SINGLE PARTICLE ECHO SIGNATURE USING LIGHT-SCATTERING THEORY
J.A. ANDERSON, Southern Univ. A & M College, School of Engineering, *Baton Rouge, Louisiana* 70813 (NSG 8028)

A mathematical model has been devised to describe light intensity lobe-configuration on scattered light incident upon a spherical test particle of a specific diameter size and index of refraction. The lobe-configuration also considers the angle of incidence as a parameter, and the 'angle of scatter,' theta s, is the output parameter. Theta s is a function of test particle diameter and index.

The objective of the research was to develop a theoretical model which predicted diameter sizes of singly considered glass heads from the lobe-configuration of scatter light (echo signature). This objective has been partially achieved. The research terminates November 14, 1977.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0010, A CHRONOLOGY AND RETRIEVAL SYSTEM FOR WALLOPS FLIGHT CENTER ATMOSPHERIC DATA
J.C. SMITH, Univ. of Maryland, Undergraduate School, *Princess Anne, Maryland* 21853 (NSG 6016)

The University of Maryland, Eastern Shore (UMES) is conducting efforts as a part of Research Grant, Office of University Affairs Grant No. NSG 6016, to respond to a need by the NASA, Wallops Flight Cener (WFC) to determine and chronologically compile the atmospheric measurement data taken in past years in that geographical area (i.e., within atmosphere sensors). The overall objective of this research grant is to develop an information-base filing and retrieval system that will provide scientists with ready access to Wallops Flight Center atmospheric data. More specifically, a computerized recovery of information by type of measurements (parameters), instruments, altitude, time of day and other pertinent facts, is visualized as an ultimate goal.

Since the Wallops Flight Center information available and its documentation on this subject was essentially unknown at the start of the project, future activities were dependent on early study efforts. Therefore, grant efforts have followed the NASA recommendation of a phased approach.

PHASE I: The first phase centered upon enlisting the aid of Wallops Flight Center people and learning of the resources available. Initial interviews and initial results yielded a Verified Basic Listing for Tabulation.

PHASE II: Phase II efforts approached the initial task to create a summary catalog of the primary data base consisting of more than eighty-six hundred (8600) project or experiment cases. Utilization of Phase I results and new development of methods, personnel training, and follow-on needs to handle the varied types of data and sources categorically related to meteorology, aeronomy, and the interdisciplinary atmospheric-geophysical sciences

has produced a Preliminary Summary Data Catalog in three (3) volumes.

It is anticipated that ongoing Library Science efforts of this grant will appreciate into future concepts and utilization towards current NASA and national goals related to the sciences, education, and technological developments. Phase IIa is fully completed, and a NASA decision for continuing into Phases IIb and III should result in a finalized catalog which will provide scientists with ready access to Wallops Flight Center atmospheric data.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0011, RESEARCH IN ORBIT DETERMINATION BY METHOD OF LEAST SQUARES AND KALMAN FILTER

J.S. BAKSHI, Univ. of The Dist. of Columbia, Graduate School, *Washington, District of Columbia* 20005 (NSG 5122)

The prediction of orbits is not a procedure which can yield exact results, but must be determined by successive approximations of increasing accuracy. In this project, two methods of orbit prediction are explored and compared with other methods for effectiveness. The methods selected for use are the method of least squares and the 'minimum variance procedure' or Kalman filter. These methods will be researched and compared with those in the literature.

This research has a secondary purpose of introducing students to the methods of scientific research and to some problems in celestial mechanics.

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PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, A STUDY OF CRYSTAL GROWTH BY SOLUTION TECHNIQUE

R.B. LAL, Alabama Agric. & Mech. Univ., School of Arts & Sciences, *Normal, Alabama* 35762 (NSG 8033)

The objective of this research investigation is to study the mechanism of crystal growth by solution technique for crystals of electrooptic materials. The mechanism of crystal growth which may be affected by space environment is being studied in relation to promising materials. A crystallizer for growing single crystals (like TGS or KDP) from solution at low temperature under steady-state concentration convection conditions is being developed. A crystallizer of this type will allow supersaturation control. Crystals will be grown at different orientations of the seed crystal to study the effect of growth conditions on different faces of the crystal. A proposal, entitled 'Solution growth of crystals in Zero-gravity', was written for Space Lab III in response to NASA A.O. No. O.A.-77-3 which has been accepted for flight on SL III. The crystallizer, which is now under fabrication, will be used for growing TGS single crystals. The present work will complement the work proposed for the flight experiment.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0002, TRANSITION RADIATIONS IN X-RAY REGION

M.C. GEORGE, Alabama Agric. & Mech. Univ., School of Arts & Sciences, *Normal, Alabama* 35762 (NSG 8001)

Research was conducted to investigate the mechanism of photon emission in the trans-optical region by the passage of charged particle in the Gev energy range through condensed matter. Mathematical details for calculating the photon production cross section as a function of incident particle energy has been worked out using Garibyan model. A computer program has been developed to calculate dN/dw as a function of particle energy with the capability to change relevant parameters like the number of detector array and absorption characteristics of the material of the detector.

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8.0003, IMPURITY STATES IN QUASI-ONE-DIMENSIONAL SYSTEMS

O.P. SINHA, Clark College, Undergraduate School, *Atlanta, Georgia* 30314 (NSG 7267)

OBJECTIVE: It is proposed to develop a theory which will explain the unusual yet highly significant properties of the (halogen) doped one-dimensional charge transfer compounds, both organic and inorganic. The model will, hopefully, explain how a Mott transition to a conducting state takes place with increased doping at a critical doping level and yet unlike a doped elemental semiconductor, the system reverts to a non-conducting state with doping much beyond this critical value.

APPROACH: We have divided the problem into three parts. (a) We are looking for the basic ingredients of a theory for the Mott transition in doped semiconductors as applicable to one-dimensional systems. The theory for the 3-D systems is known, the modification needed for applicability to 1-D systems is being sought. (b) A double-chain Hubbard model is being examined as a candidate for simulating the 1-D charge transfer compounds. A numerical expression for the charge transfer has been obtained in terms of the parameters of the double Hubbard chain. (c) A model for an impurity embedded in a double Hubbard chain as described above in (b), is being explored.

PROGRESS AND PLANS: Several ideas with regard to the extension of the Mott theory to 1-D doped semiconductor have been examined. However, further exploration is needed.

Some solutions for the double Hubbard chain have been obtained including expression for the fractional charge transfer as a function of the double-chain Hubbard model parameters. More needs to be done, however, before it can be said that the model simulates the behavior of a known compound like TTF-TCNQ in which the expected charge transfer is about 0.8.

It will be some time before we get to the part (c) of the approach described above.

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8.0004, OPTICAL EFFECTS OF CONTAMINATION OF INFRARED WINDOWS BY MATERIALS IN OUTER SPACE

E. SILBERMAN, Fisk University, School of Liberal Arts, *Nashville, Tennessee* 37203 (NGR 43-021-002)

Present objectives of this research project include the measurement and analysis of factors affecting the vacuum outgassing of silicone-based polymers, particularly siloxane containing paints and adhesives. Infared spectroscopy has been the primary method of investigation, and is being used to characterize not only the composition of the materials outgassed but also to provide a quantitative measure of their outgassing rates. Specifically, the influence of time, temperature, and solar radiation on the outgassing rates are being analyzed.

During the final period of this study, the data previously gathered will be correlated with published thermodynamic data on the siloxanes to see if the outgassing measured can be interpreted in terms of the diffusion of short-chain molecules through a cured polymerized film or in terms of other factors controlling the kinetics of the process.

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8.0005, ASYMPTOTIC PROPERTIES OF SCATTERING AMPLITUDES

R.E. MICKENS, Fisk University, School of Liberal Arts, *Nashville, Tennessee* 37203 (NSG 8035)

The objective of this research is to obtain a description of hadron-hadron and neutrino-hadron scattering at asymptotic energies. In particular, we will consider proton-proton and neutrino-proton scattering. In the case of proton-proton scattering, we will generalize an earlier model of ours to include spin and phase effects and use these amplitudes to calculate the differential cross section, the various polarization parameters, and the phases of the different amplitudes. For neutrino scattering processes, we will be concerned with obtaining upper bounds on the total cross section, investigating the charge structure of the neutrino by means of its charge form factor, and determining the threshold behavior of neutrino amplitudes.

The techniques to be used will include those properties of scattering amplitudes which have been obtained from the principles of axiomatic field theory, namely, unitarity, analyticity, and crossing. In addition, use will be made of the theory of functions of a complex variable and functional analysis.

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8.0006, DISTRIBUTION OF EXTRA-IONIC ELECTRONS IN SEMI-METALLIC ENVIRONMENTS BY NUCLEAR QUADRUPOLE RESONANCE TECHNIQUES

A.N. MURTY, Grambling State University, Undergraduate School, *Grambling, Louisiana* 71245 (NGR 19-011-016)

Earlier investigations in pure Indium, Antimony, and Gallium indicated that the extra-ionic electrons in these lattices provide appreciable contribution to the (EFG) electrostatic field gradient at the nuclear site. The major objective of our project has been an in-depth study of the nature of the lattice charge distribution in semi-metallic environments by Nuclear Quadrupole Resonance techniques. The lattice charge distribution is altered in a controlled manner: (a) by the addition of trace amounts of other p-block donor and acceptor impurities to the host lattice; (b) by hydrostatic compression; and (c) by passage of small electric current through the solid; the effects on the NQR line width and the frequency were studied. Unlike in the molecular solids, even small amounts of impurities (0.1-1 percent by weight) caused considerable broadening, wiping the signal independent of the nature of impurity. Both temperature and pressure variation studies indicated a much larger frequency gradient. Similarly passing a D.C. current of about 50 MA through the sample resulted in a negative frequency shift of the order 50 kHz compared to 10 kHz at 50 kV/cm in molecular solds. The conduction electron contribution to the EFG is not only appreciable in semi-metallic environments, but also the conduction band occupancy is highly sensitive to the lattice perturbations. Presently, our studies at very low impurity concentrations (0.001-0.05 percent by weight) are in progress.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0007, STUDY OF ULTRA-LOW-FREQUENCY OSCILLATIONS AT THE SYNCHRONOUS ORBIT USING DATA FROM ATS-6, SMS-1, AND SMS-2

W.D. CUMMINGS, Grambling State University, Undergraduate School, *Grambling, Louisiana* 71245 (NSG 8034)

Particle and magnetic field data from the ATS-6 spacecraft have been combined to study a Pc4 pulsation event. Using the observed ambient and perturbation magnetic fields in conjunction with the plasma drift velocity, we calculate the Poynting vector of the wave assuming the electric field is given by the frozen field approximation. The Poynting vector gives convincing evidence that the wave is a standing hydromagnetic wave along the magnetic field. The phase relationship between the magnetic and plasma drift velocity oscillations is consistent with the occurrence of an odd harmonic of the standing wave. Comparison of observed particle fluxes with model predictions demonstrates that the fundamental mode is the most reasonable interpretation of the data.

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8.0008, ULTRASONIC STUDIES IN MAGNETIC FLUIDS

D. CHUNG, Howard University, School of Liberal Arts, *Washington, District of Columbia* 20001 (NSG 5186)

The ultrasonic properties of various ferro fluids are being studied under the influence of external magnetic fields. A highly anisotropic behavior has been observed as a function of magnetic field and is currently being investigated. Further studies on the hydrodynamical properties under the influence of both a.c. and d.c. magnetic fields will be made.

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8.0009, A.C. MAGNETIC STUDIES ON PERMALLOY CORES AND AMORPHOUS SYSTEMS

R.M. CATCHINGS, Howard University, School of Liberal Arts, *Washington, District of Columbia* 20001 (NSG 5186)

Magnetic properties of permalloy cores, glasses and glass-ceramic materials are being studied by making a.c. magnetic susceptibility measurements as a function of temperature and frequency. Studies are currently in progress on various glass systems and a superconducting alloy, and are being initiated on permalloy cores. Losses associated with the Barkhausen effect in permalloy cores will be investigated thoroughly as these cores are used in fluxgate magnetometers quite extensively on spacecraft. The noise in these magnetometers is probably related to the Barkhausen effect in the permalloy cores.

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8.0010, RESEARCH IN ELECTRON SPECTROSCOPY

T. TSANG, Howard University, School of Liberal Arts, *Washington, District of Columbia* 20001 (NGR 09-011-057)

Photoelectron and Auger spectroscopic technics have been used for material research and geophysics research. Auger spectra of transition metals have been measured and we have clarified the conditions of the Auger electron localization on individual metal atoms. We are planning on further studies of metals and also further research on radiation damages of various materials.

We have also studied the distribution coefficients of minor constituents in crystal growth processes from the melt. It was found that the distribution coefficients are related to both ionic-radius and lattice energy.

Satisfactory agreements between theory and experimental data have been achieved.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0011, INVESTIGATION OF RADIATION DETECTORS FOR ENVIRONMENTAL TRACE ELEMENTS

G.A. FERGUSON, Howard University, School of Engineering, *Washington, District of Columbia* 20001 (NGL 09-011-046)

An X-ray diffractometer has been assembled to monochromatize radiation from a continuous source. The range of energies available is 10-100 KeV. This facility has been employed to specify the energy response of NaI(Tl) radiation detectors which have been used by NASA. Current plans are in progress for its use in the characterization of the response of the low-intensity X-ray imaging scope (LIXISCOPE) recently developed by NASA.

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8.0012, POSITRONIUM STUDIES

D. JUDD, Howard University, School of Liberal Arts, *Washington, District of Columbia* 20001 (NSG 5186)

Positronium annihilation spectral studies can be used to resolve the types of interactions which characterize weakly bound states of positronium atoms in pores and at the surface of powder grains. Recent calculations concerning interstellar hydrogen

generation show the consistent presence of particulate matter as a part of the dust cloud. The gas phase processes which we will examine in this laboratory will shed considerable light on these astrophysical calculations as well as on the solid-state diffusion process. Other molecules of interest are O2 ions and OH ions. They will be studied in this work using positrons and a probe and a precision delayed coincidence system.

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8.0013, PHOTOELECTRON AND AUGER SPECTROSCOPY

T. TSANG, Howard University, School of Liberal Arts, *Washington, District of Columbia* 20001 (NSG 5186)

Photoelectron and Auger spectroscopy are highly surface-sensitive techniques and have been used extensively for studies of valence states of transition-metal compounds, and has been used successfully to study the silicates with compositions similar to the lunar fines, under successive stages of ion bombardment. These experiments are being extended to other samples of geophysical interest such as volcanic ashes, which are fine particles of crushed, solidified lava foams. As the production of foam requires the presence of a foaming agent, these ashes are being studied by Auger spectroscopy before and after the surface layers have been sputtered away by ion bombardment. These experiments may clarify the mechanism of ash formation which is thought by many to have a major influence on the climate.

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8.0014, ANALYSIS OF PULSED MAGNETOGASDYNAMIC DIRECT ENERGY CONVERTER CONFIGURATIONS

C. SPIGHT, Morehouse College, School of Arts & Sciences, *Atlanta, Georgia* 30314 (NSG 8039)

A coupled theoretical and experimental research programme in high magnetic Reynolds number magnetogasdynamics has been applied to the design of pulsed inductive direct energy convertors. A multiple time, multiple spatial scale analysis of the conversion process has been completed which includes a linearized stability analysis of all likely disruptive field and flow perturbations. That analysis has shown the criticality of operating such devices in the trans-Alfvenic regime and has identified operating regime constraints for simple radial flow generator configurations. A complete hypervelocity plasma generator facility has been assembled and has now been dedicated to producing hypersonic flows in test generator configurations in an attempt to validate theoretical predictions. The results are expected to be applicable to convertors which would operate using impulsive source flows from laser-solenoid fusion reactors.

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8.0015, A COMPREHENSIVE EXAMINATION OF ION ACOUSTIC WAVES IN MULTI-ION COMPONENT PLASMAS

J.M. TURNER, Morehouse College, Graduate School, *Atlanta, Georgia* 30314 (NSG 8043)

This project is an experimental and theoretical study of saturation mechanisms in ion acoustic waves; of particular interest are cases of waves in two-ion component plasmas. One ion will be dominant both in terms of number density and mass with the light ion having a number density on the order of 1-5 percent of the former. Wave growth and saturation in positive column plasmas will be examined along with ion heating. The data will be compared with the predictions of a variety of theories including trapping and resonance broadening to identify a specific mechanism as being the cause of the saturation.

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8.0016, THE CALIBRATION OF PHOTOGRAPHIC AND SPECTROGRAPHIC FILMS

E.C. HAMMOND, Morgan State College, Graduate School, *Baltimore, Maryland* 21212 (NSG 5074)

The purpose of this project is to continue to develop, evaluate and utilize densitometric techniques and procedures for the determination of the relative and absolute characteristics of standard and special spectroscopic films and plates in the infrared, visible, and the ultra-violet spectral regions. NASA's new Space Shuttle program has pointed to the need for studies which calibrate the various types of spectroscopic and photographic films for exposure caused by various thermal effects, cosmic-ray effects, vacuum effects in the presence of various atmospheres of hydrogen, helium, and other gases, long-term and short-term aging effects, film processing procedures and techniques, and grain structure variability in density from emulsion to emulsion. This proposal, begun during the initial year of the 1976-1977 grant, would permit the writer to continue his calibration of various photographic and spectroscopic film batches used by NASA's Laboratory for Astronomy and Solar Physics. In developing the present proposal, the investigator intends to utilize as an additional technique in calibrating these films and plates two spectral sensitometers which have been developed and patented by the Laboratory for Astronomy and Solar Physics. During the initial year, 1976-1977, experimentation and analysis was begun on IIaO spectroscopic film involving liquid nitrogen exposure effects, heat treatment effects involving heating the film and developing it under standard conditions, heating the developer and fixer utilizing standard development times, and the effects of an intense magnetic field on the emulsion of IIaO film.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0017, RESEARCH IN THE MANY-PARTICLE THEORY OF NUCLEAR SYSTEMS WITH APPLICATION TO NEUTRON STAR MATTER

C.H. YANG, Southern Univ. A & M College, School of Science, *Baton Rouge, Louisiana* 70813 (NGR 19-005-006)

This project is a theoretical physics research program. Under the project, we have made an extensive and thorough study on the many-particle theory of nuclear systems, especially, the correlated-basis-function method. In one part of this project, extensive constrained-variational calculations on neutron matter and symmetrical nuclear matter for simple central two-nucleon potentials containing hard cores have been thoroughly studied. This study gives us a clear picture on how rapid our cluster expansion converges for different sets of constraints, and for two- and three-parameter correlation functions. We are also hoping that this study will shed some light on and help us resolve the Brueckner-Jastrow discrepancy in nuclear matter. In the other part, we employ the Yang-Clark method which combined the correlated-basis-function (CBF) and Bardeen-Cooper-Schrieffer (BCS) methods in treating superfluidity problems in neutron-star-matter. With the successful employment of our method in treating the neutron-star-matter problems up to now, we are planning to extend the method to treat the problems involving pairing correlations in liquid 4He, mixture of 3He in 4He, and also the ground state of neutron matter with periodic density variation.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0018, ELECTRON-IMPACT EXCITATION OF MOLECULAR NITROGEN

H.W. JONES, State University of Fla. Sys., School of Arts & Sciences, *Tallahassee, Florida* 32306 (NSG 901)

A distorted wave procedure is being used to calculate the total and differential, electron-molecular nitrogen impact cross sections, for the elastic and electronic excitation processes. The distorted wave method is a variationally stable technique based on a generalization of the multichannel Kato identity, and a single-center representation of the target is used. However, the scattering equations, which are solved using a non-iterative integral equation algorithm, include only the spherical part of the interac-

tion potential, while the non-spherical part appears in a matrix element sandwiched between the calculated projectile orbitals. The collision energies of primary interest lie between ten and one hundred electron-volts. Consistently therefore, the exact exchange potential is approximated by a truncated expansion in inverse powers of the collision energy. The procedure will also be used to calculate rotational and vibrational cross sections for the electron-nitrogen molecule collision.

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8.0019, SPECTRAL AND MONTE CARLO PREDICTABILITY STUDIES

J. TENENBAUM, State University of New York, Undergraduate School, *Purchase, New York* 10577 (NSG 5077)

This project continues the spectral analysis of the Goddard Institute for Space Studies (GISS) model of the general circulation of the atmosphere, and applies these techniques to improve the predictions made by the model. Numerous studies of the limits of atmospheric predictability have concluded that energy in the high-frequency portion of the spectrum spreads to all wavelengths in a period of 1 to 2 weeks. Spectral techniques provide details of this spreading. In addition, this project deals with two approaches to maximizing the available information at times of the order of the predictability limit. One studies the time dependence on the long wave spectral coefficients. The other uses a combination of Monte Carlo and linear regression techniques to try to produce smaller mean-square errors than individual forecasts.

During the current year the previous one-dimensional spectral analysis techniques have been generalized to two dimensions to avoid aliasing problems. These two-dimensional results are currently being used to analyze topographic forcing 500 mb height error spectra, and interannual variations. At the same time the one-dimensional results are being improved by examining the effects of errors in the observational vertical velocity fields.

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8.0020, STUDY OF THE FAR-INFRARED LATTICE PROPERTIES OF GALLIUM ARSENIDE

J. BREECHER, Talladega College, Undergraduate School, *Talladega, Alabama* 35160 (NGR 01-007-009)

We have measured the far-infrared reflectivity and transmission of high-resistivity GaAs at room and liquid nitrogen temperatures. The spectral region of interest includes the transverse optical frequency and also two multiphonon frequencies. Our current effort is in the analysis of these experimental results to determine the effect of a frequency-dependent lattice damping constant on the shape of the reflectivity and transmission curves.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0021, EXPERIMENTAL DETERMINATION OF THERMODYNAMIC PROPERTIES OF SULFURIC ACID AT TEMPERATURES FOUND IN THE ATMOSPHERE

R.A. MORRISON, Talladega College, Undergraduate School, *Talladega, Alabama* 35160 (NSG 2217)

OBJECTIVE: To determine the equilibrium vapor pressure above 100% sulfuric acid at temperatures from -50 to 20 degrees C. To determine the vapor pressure of other concentrations of the acid sufficiently well to serve nucleation calculations for the troposphere and Junge layer.

APPROACH: Knudson-cell determination of the total pressure in equilibrium with the liquid, using a vacuum-recording microbalance. Partial pressures will be determined with a quadrupole mass spectrometer equipped for synchronous detection. Second and third-law calculations will be used.

PROGRESS: Program is almost on schedule. The microbalance has been purchased and is operating satisfactorily in the UHV vacuum system. The rate of mass loss confirms previous results that the calculation of Gmitro and Vermeulen predicts values of the pressure that are high--perhaps by as much as a factor of 10 for 100% acid at room temperature. Experiments to date have centered on the water-acid azeotrope at 98% acid. The thermal control system is currently under construction. We find a strong dependence of vapor pressure on temperature.

PLANS: Partial pressure determinations will be undertaken next year, when a mass spectrometer will be purchased. Until this is done, all measurements must be tentative, since the pressure determination uses the average molecular weight of the effusing species.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0022, SIZE EFFECT STUDIES OF THIN METAL FILMS

S.J. BRIENT, Univ. of Texas, School of Science, *El Paso, Texas* 79902 (NSG 3146)

Size effect parameters of thin metal polycrystalline films are to be obtained by direct comparison with their epitaxial form. Two approaches will be attempted. First, a comparison of the two forms for a series of different thicknesses formed during the same evaporation. A higher substrate temperature for the epitaxial films during evaporation will be made possible by using a split substrate holder with the two halves held at different temperatures. Second, a calculator controlled instrumentation system which allows accurate and reproducible control and measurement of the evaporation process will be used to obtain the epitaxial and polycrystalline forms to be obtained in separate evaporations. This will allow sufficient film thicknesses to obtain accurate analysis of the size effect parameters. In both approaches the upper film surface roughness will be varied in order to obtain 'bulk' values of resistivity, mean free path, and specularity parameter from the epitaxial films. These values of resistivity, mean free path, and specularity parameter will then allow the polycrystalline films to be analyzed according to a linearized form of the Mayadas-Shatzkes theory. The split substrate system is being fabricated and trial runs on gold indicate the experimental approach is feasible.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0023, MATERIAL SCIENCE AND SOLID-STATE PHYSICS STUDIES WITH POSITIVE MUON SPIN PRECESSION

C.E. STRONACH, Virginia State College, Graduate School, *Petersburg, Virginia* 23806 (NSG 1342)

The purpose of this project is to measure the internal magnetic fields of solids, and the dynamical behavior of muons, particularly the diffusion rates, in solids. Of particular interest are samples of iron diluted with small concentrations of aluminum impurity. Preliminary studies suggest an increase in the hyperfine field at the interstitial sites where the muons stop.

Other materials currently under study include aluminum alloyed with small amounts of copper, niobium, and beryllium. Also of interest are intermetallic compounds, semiconductors, rare earths, and hydrogen-absorbing materials.

These studies are being performed at the Space Radiation Effects Laboratory, utilizing the tertiary positive muon beam from the 600-MeV synchrocyclotron. Polarized muons are stopped in samples to which appropriate external magnetic fields are applied and timing spectra are taken of the interval between the stopping of the muons and the detection of the corresponding decay positrons. From these spectra the internal fields and the muon diffusion rates can be determined.

A series of experiments is planned for late September 1977, and another for spring 1978. Studies have been completed on chromium and manganese aluminosilicate glasses, and considerable progress has been made on vanadium, niobium, beryllium, and the iron-aluminum alloys.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0024, CALCULATION OF TOTAL CROSS SECTIONS FOR CHARGE EXCHANGE IN MOLECULAR COLLISIONS
J.W. IOUP, Xavier University of Louisiana, School of Arts & Sciences, *New Orleans, Louisiana* 70125 (NSG 1361)

Previous research accomplished under this grant included the theoretical investigation of low-energy collisions of nitrogen ions with nitrogen molecules. Theoretical developments and calculations reported in the literature were applied to experimental data obtained by Dr. Al Smith of the Instruments Research Division at NASA Langley Research Center.

Present and future work involves application of collision theories to gas molecule-surface collisions. The effects of atmospheric gas collisions with metals will be investigated to determine possible relationships with stress corrosion. Because of the analytical complexity, numerical techniques and digital computation will be used.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0025, EXPERIMENTAL AND THEORETICAL STUDY OF V-VI-VII COMPOUNDS
C.Y. FONG, Univ. of California, School of Letters & Science, *Davis, California* 95616 (DF049470; AF-AFOSR-3390-77)

AF function - microwave electronic devices are important elements of Air Force communications and countermeasures systems. Opportunity -improved performance can be expected from the use of new solid-state materials for the generation and detection of microwave signals. Present microwave solid-state device performance is limited by the properties associated with the structure of the device material. Objective - the objective of this research program is to determine if the electronic band structure of these materials exhibits sufficiently interesting negative mass states to warrant further investigations of electron transport properties to ascertain their potential for utilization in solid-state microwave amplifiers and generators. How work contributes - these compounds belong to a class of group V-VI-VII compounds that have a number of interesting physical properties possibly including negative mass charge carriers suggesting potential technological utility, especially for microwave devices. It is anticipated that each of these semiconductors (listed below) have negative mass charge carriers.

This research investigated experimentally and theoretically the electronic band structure of the semiconductors BiScl, BiSi and BiSel.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

8.0026, A RESEARCH PROGRAM IN NEUTRINO PHYSICS, COSMIC RAYS AND ELEMENTARY PARTICLES
F. REINES, Univ. of California, School of Physical Sciences, *Irvine, California* 92664 (EY-76-C-03-0010 019)

This research is generally in the area of weak interactions, very low counting and cosmic rays. Under investigation is the double-beta decay of Se82 using a cloud chamber, counter configuration. Studies of the reaction neutrino e plus e- yields neutrino e plus e- and the associated neutrino e spectrum from fission continue as does work preparatory to a check of the charged and neutral current reactions: neutrino e plus d yields n plus n plus positron, neutrino e plus d yields n plus n plus neutrino e.

A 7 cubic meter liquid scintillation detector has been operated in a preliminary way to study backgrounds from cosmic rays and radioactivity in a salt mine 1900 feet below sea level.

Work continues on an experiment to test for the absence of a small admixture of an advanced potential in an electromagnetic wave.

Work has been started on a test of the inverse square law of gravitation at short distances (approximately 2 cm).

Studies are in process to develop a large liquid argon detector with spatial resolution for neutrino experiments at Fermilab.

RESULTS: The reaction neutrino plus e- yields neutrino e plus e-was detected and ancillary data on neutrino e plus p yields n plus positron has been obtained to test for the presence of neutrino oscillations. The double-beta decay detector has yielded signals which are being tested to determine whether they originate from double-beta decay or internal conversion of single beta emitters in the source foils.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of High Energy & Nuclear Physics

8.0027, ACQUISITION OF EQUIPMENT FOR NEUTRAL PARTICLE PRODUCTION IN HIGH-ENERGY ELECTRON-POSITRON COLLISIONS
C.W. PECK, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (PHY75-22980 A01)

An experiment to measure the neutral states of matter produced in e plus e- annihilations will be conducted using a hemispherical array of NaI crystal detectors. The effort, to be performed in collaboration with other research groups from Stanford, Princeton, Harvard and the Stanford Linear Accelerator Center will be performed at the SLAC SPEAR storage ring facility. Information which is expected to be obtained will shed light on the quark structure of matter, particularly that involving the fourth or charm quark.

This is a continuation of NSF grant PHY75-22980.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0028, HIGH-ENERGY THEORETICAL PHYSICS
B.R. DESAI, Univ. of California, School of Physical Sciences, *Riverside, California* 92502 (PHY76-03676 A01)

Research will be done on the problem of the confinement of quarks and to investigate the consequences of quantum chromodynamics for baryons by the method of infrared regularization. The Regge trajectory for the (non-Pomeron) mesons as bound states of quark-antiquark system will be obtained from the Feynman diagram summation technique for the leading logs terms. Within the S-matrix framework, the possible distinction between the f and the Pomeron trajectory will be explored using topological expansion ideas. Other topics will also be studied. This work represents a continuation of that currently supported by Foundation grant PHY76-03676.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0029, THE RESPONSE OF SUPERCONDUCTORS TO VARIATIONS IN IMPURITY CONTENT AND APPLIED PRESSURE
M.B. MAPLE, Univ. of California, Inst. for Pure & Ap. Phys. Sc., *San Diego, California* 92038 (EY-76-S-03-0034 227)

It is proposed to continue an experimental research program to investigate the response of superconductivity to variations in impurity content, throughout the entire range of solute magnetic character, and applied pressure. A major effort, initiated during the past year, will be continued to determine how impurities, particularly those which are magnetic, affect the superconducting properties of A15, ternary molybdenum chalcogenides, and other high-temperature superconducting matrices. The primary objectives of this investigation will be to search for systematic behavior which yields information pertaining to the high critical temperatures of these materials, and to study an effect in which the upper critical magnetic field of type II superconductor can be enhanced by means of the exchange field arising from the antiferromagnetic exchange coupling between conduction electron and impurity spins. We also plan to continue our development of a 'Superconducting Spectroscopy' for determining the magnetic state of local moments in metals, detailed studies of the superconducting and normal state physical properties of various matrix-impurity systems. Particular emphasis will be placed on superconducting matrix - rare-earth impurity systems in which the rare-earth ion has an unstable valence in order to determine how 'valence fluctuations' affect superconductivity. We also plan to continue a new line of research, initiated during the past year, on superconducting rare-earth compounds in which the rare-earth ions have partially filled 4F sheels in order to study the interaction between superconductivity and long-range magnetic ordering of

the rare-earth magnetic conductors Zn, Cd and Al to establish the detailed superconducting,normal state phase boundary on the boundary of the temperature-pressure plane in order to make comparisons with existing theory and to determine whether pressure can destroy superconductivity in these elements. Experiments are also proposed to investigate the superconductivity of graphic compounds under pressure.

RESULTS: Very high magnetic fields in excess of 400 kG have been found in the series of RExMo6Se8 compounds (RE denote rare earth). Conditions for the coexistence of superconductivity and long-range magnetic order have been investigated in the RExMo6Se8 and RERh4B4 compounds. (Text abridged.)

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Basic Energy Sciences

8.0030, SPECTROSCOPY OF CONDENSED MATTER SYSTEMS
S. SCHULTZ, Univ. of California, Graduate School, *San Diego, California* 92037 (DMR77-14659)

This research program is a continuation and extension of work initiated under grant DMR-7424361. The relatively new tool of fluctuation spectroscopy will be used to aid in a determination of the dynamical properties of a variety of condensed matter systems which are extremely difficult to measure by alternative techniques. Applications range from the rate constants in simple chemical kinetics to the confirmational chemisorption, and to 1/f noise. Another topic of this research program will be the investigation of crystallization processes. Experiments relating to the EPR and ENDOR of biomolecules will be carried out also.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0031, DYNAMICS OF LIQUID STRUCTURE
T.A. LITOVITZ, Catholic University of America, School of Arts & Sciences, *Washington, District of Columbia* 20017 (DMR77-14555)

This systematic investigation is aimed at discovering the nature of the elementary processes that govern translational molecular motions and structural dynamics in relatively simple liquids. The basic approach is to take advantage of the time-dependent information about the relative motion of molecules that can be inferred from the interaction-induced components of the infrared absorption and depolarized Rayleigh scattering spectra, and from molecular dynamics computer simulation experiments. Molecular dynamics computations are used to 'calibrate' each experiment by performing them on a model system whose dynamics are known. Time correlation functions of quantities that depend on interparticle separations are investigated rather than just molecular positions. In this way one expects to be able to isolate a new facet of the dynamics of structural breakup in liquids which is revealed when one looks at the motion of the particles from the reference frame of their drifting environments rather than from a laboratory-fixed viewpoint.

This is a continuation of research supported under DMR 76-17514. First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0032, SUPERCONDUCTING PROPERTIES OF ANISOTROPIC AND ION IMPLANTED MATERIALS
R.C. MORRIS, State University of Fla. Sys., School of Arts & Sciences, *Tallahassee, Florida* 32306 (DMR76-10845)

This project involves a study of type II superconductivity by the investigation of the anisotropy of superconducting materials, the effect of impurities on superconductivity, particularly magnetic impurities, and the interplay between the impurity effects and the anisotropy. Studies of the 60 degrees and 180 degrees anisotropy in the upper critical field of the hexagonal tungsten bronzes, recently discovered, will be undertaken as a function of metal ion type and concentration. Recent observations also show that some of these materials exhibit anomalies around 150K in the normal resistivity, Hall coefficient, and Seebeck effect. These anomalies will be investigated in detail and attempts will be made to determine if they are correlated with the superconducting properties. The effect of magnetic and induced moment impurities introduced into layered-structure superconductors on the superconducting and normal electrical properties of these materials will be studied. Also, investigation of the effect of different metal ions implanted in superconducting thin films at different concentrations and energies will be carried out.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0033, INELASTIC SCATTERING OF MEDIUM-ENERGY PROTONS AND HEAVY IONS; NUCLEAR STRUCTURE AND REACTION MECHANISMS
A. SCOTT, Univ. of Georgia, School of Arts & Sciences, *Athens, Georgia* 30602 (PHY76-08788 A01)

Inelastic scattering of protons, alpha particles, and heavy ions is studied in order to learn about reaction mechanisms, the effective nucleon-nucleon interaction, and nuclear deformations. The experiments will use cyclotrons located at Indiana University, the University of Maryland, and Oak Ridge. Proton reactions on zirconium and lead which excite relatively simple final states are selected in order to focus the study on questions concerning the reaction mechanism or effective interaction.

The heavy-ion work relies on the interference between coulomb and nuclear inelastic amplitudes to extract the quadrupole deformations of various excited states of theoretical interest. This is a continuation of work supported by grant PHY76-08788.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0034, THEORETICAL STUDIES IN ELEMENTARY-PARTICLE PHYSICS
W. TUNG, Illinois Inst. of Technology, School of Engin. & Phys. Sci., *Chicago, Illinois* 60616 (PHY76-08683 A01)

Research will include work on: (1) the nature of the quark model for strongly interacting particles and its relation to the current algebra of weak and electromagnetic interactions; (2) the theory and phenomenology of high-energy lepton-hadron processes.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0035, THEORETICAL SOLID-STATE PHYSICS
M.H. COHEN, Univ. of Chicago, Graduate School, *Chicago, Illinois* 60637 (DMR77-12637)

Theoretical studies of condensed matter systems previously supported by NSF grant DMR-7621298 will be continued and extended in new directions. Topics to be investigated include the following: (a) one-dimensional and nearly one-dimensional systems with emphasis on electron-lattice interaction, transport and magnetic properties of one-dimensional materials and on nonlinear dynamics of a one-dimensional field theory; (b) properties of liquid and superfluid helium-3 including study of the pairing mechanism and a search for an explanation of the phase diagram in zero and finite magnetic field; (c) disordered systems including an attempt to explain static and dynamical properties of the spin glasses in a cluster mean field theory and to formulate an itinerant model of a spin glass; (d) critical and collective phenomena including work on the equilibrium properties and dynamics of classical quantum mechanical systems near critical points; (e) dynamics of fluids including work centered on kinetic theory approaches to the description of quantum and classical fluids and plasmas; (f) metal-insulator transition including work on a new method for deriving the Green's function for the Hubbard model.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0036, ELEMENTARY-PARTICLE THEORY
R.J. OAKES, Northwestern University, School of Arts & Sciences, *Evanston, Illinois* 60201 (PHY76-11445 A01)

Oakes' general area of research will continue to be the theory of the interactions of elementary particles at very small distances. Specific research projects to be investigated are in the areas of quark models, gauge theories, neutrino scattering, SU(4) x SU(4) chiral symmetry breaking, the UA(1) problem, lepton production in hadron collisions and multichannel scattering phenomenology.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0037, HIGH-MAGNETIC-FIELD SUPERCONDUCTIVITY AND MAGNETISM IN TRANSITION METALS AND ALLOYS
R.R. HAKE, Indiana University, School of Arts & Sciences, *Bloomington, Indiana* 47401 (DMR77-10545)

Research begun under NSF grant No. DMR7509940 will be continued and extended. A broad experimental program in the study of high magnetic field superconductivity in the transition-metal alloys will be undertaken and a major part of the program will involve the relationship between superconductivity and magnetism. Three areas of study are: 1) fluctuation effects and Type II superconductivity, 2) normal state electronic properties of disordered transition-metal alloys, and 3) spin glasses and Kondo systems.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0038, X-RAY STUDIES OF SOLID-STATE PROPERTIES - VALENCE CHARGE DENSITIES AND ACOUSTOELECTRICALLY AMPLIFIED PHONONS
R. COLELLA, Purdue University, School of Science, *Lafayette, Indiana* 47907 (DMR77-06744)

A novel method for investigating bonding charges in III-V compounds has been applied to InSb. These investigations are being pursued at high pressures, up to 100 Kbar, in order to distinguish between effects due to thermal vibrations and changes in interatomic distances.

A preliminary X-ray study of acoustoelectric (A.E.) phonons has been reported. In the Bragg case (reflection) the Principal Investigator has been able to observe, for the first time, satellites generated by monochromatic phonons. Time-resolved experiments are now in progress in order to discriminate between primary phonons and those generated through wall reflection and other processes.

This is a continuation of research supported under Grant No. DMR 75-10194.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0039, DYNAMIC PROPERTIES OF LIQUID CRYSTALS
C.E. TARR, Univ. of Maine, School of Arts & Sciences, *Orono, Maine* 04473 (DMR75-06474 A03)

A systematic study of the dynamic properties of liquid crystals continues. The primary experimental technique is pulsed nuclear magnetic resonance spectroscopy. Electric fields are used for orientational studies to determine spin-lattice relaxation times T1, Tp, and T1D. These are correlated with information obtained from the nuclear magnetic resonance line shapes. Particular attention is given to the effect of molecular order and order fluctuations on spin-lattice relaxation and to the study of transient molecular order under the influence of pulsed electric fields, with emphasis upon phase transitions and pre-transitional effects.

This is a continuation of research supported under DMR 75-06474.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0040, PLASMA DYNAMICS
A. BERS, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (ENG77-00340)

This is an analytical and experimental study of nonlinear plasma phenomena in regimes typified by very large amplitude coherent waves and strong turbulence and a study of plasma devices where strong nonlinearities or nonequilibrium phenomena are dominant. Specific areas to be investigated include: A. Third-order perturbation formulation of nonlinear wave interactions, nonlinear evolution of coupled modes in inhomogeneous plasmas, and resonance broadening and strong turbulence theory of wave interactions. B. Development of improved strong turbulence theory, application of properly 'renormalized' dielectric coefficients to drift and trapped particle modes to determine saturation amplitudes and transport properties. C. Experimental studies of nonlinear wave behavior, saturation phenomena in single-mode and multi-mode unstable systems, control of instability growth by introduction of weak turbulence. D. Physics and application of intense relativistic electron beams with particular emphasis on experimental studies of very strongly nonlinear plasma-wave interactions and on the efficient production of millimeter and submillimeter radiation.

This is a continuation of research previously supported under NSF grant ENG-7506242 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

8.0041, MATH ANALYSIS OF FIELDS AND PARTICLES
I.E. SEGAL, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (MCS76-02762 A01)

This work continues that done under MCS76-02762.

Segal's main purpose is to develop the theory of infinite-dimensional representations of space-time symmetry groups, and mathematical generalizations thereof; to treat their relation to invariant wave equations, especially in forms locally similar to the Maxwell, Dirac, and other physically applicable equations; to investigate the second quantization of the fields defined by these representations and equations (i.e., corresponding canonically induced actions in infinite-dimensional tensor spaces); and to consider possible applications to the mathematical description of apparently elementary particles and their interactions. He will also consolidate earlier investigations applying group theory and causality considerations to very large-distance physics, including quantitative statistical analysis of new observational data, and exploration of possible relations to the theory of gravitation.

SUPPORTED BY U.S. National Science Foundation, Div. of Mathematical & Computer Sciences

8.0042, NUCLEAR STRUCTURE THEORY
K.T. HECHT, Univ. of Michigan, School of Liberal Arts, *Ann Arbor, Michigan* 48104 (PHY77-15273)

Research in theoretical nuclear physics initiated under NSF grant PHY75-18443 A01 will be continued. Specific research areas under current investigation include (1) the study of alpha and more complicated cluster structures in nuclei and their contributions to multi-nucleon transfer processes, (2) the development of high spin members of rotational bands through core excitations, (3) the study of deformed nuclei through the pseudo-SU3 coupling scheme, and (4) the effect of core excitations on Coulomb displacement energies.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0043, STRONGLY INTERACTING QUANTUM SYSTEMS
L.M. SANDER, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (DMR74-12003 A01)

Theoretical studies of strongly interacting quantum systems previously supported by NSF grant DMR74-12003 will be continued. Three general topics concerned with interacting electron systems will be addressed. The first is the study of the dynamical modes of the electron-hole liquid with regard to the binding to impurities and luminescence line shapes. Secondly, problems in the theory of metals which can be treated using density functionals will be treated, including 1) refinements to the theory of a point charge impurity and 2) metallic hydrogen. Finally, questions involving the two-dimensional physics of electrons on the surface of liquid helium and helium adsorbed on graphite will be investigated.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0044, NONCRYSTALLINE MAGNETIC MATERIALS
A.M. DEGRAAF, Wayne State University, School of Liberal Arts, *Detroit, Michigan* 48202 (DMR76-17036 A01)

Theoretical studies will be continued considering the properties of non-crystalline magnetic materials in general and the remarkable properties of cobalt and manganese aluminosilicate glasses in particular. In addition, the coordination of several experiments on these glasses with several research groups will be carried out. Various models of amorphous magnetism will be studied theoretically and compared with experimental results. In particular, an Anderson model modified to reflect the existence of magnetic domains in these aluminosilicate glasses will be used to interpret a wide variety of experimental data. This research will contribute to a better understanding of non-magnetic glasses, spin-glass alloys and other amorphous magnetic materials.

This is a continuation of research begun under NSF Grant 0DMR76-17036.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0045, DESIGN, CONSTRUCTION, AND TESTING OF A SUPERCONDUCTING CYCLOTRON FOR HEAVY-ION RESEARCH
H.G. BLOSSER, Michigan State University, School of Natural Sciences, *East Lansing, Michigan* 48824 (PHY76-83254)

This work is the logical continuation of the work in progress under NSF grant PHY75-01080 A02 consisting of the design and construction of a superconducting magnet with an azimuthally varying field and very high field strength. The high field (5 Tesla) will be accomplished by using superconducting wire in the coils. The object of the project is to produce a high-field magnet of sufficiently high quality to serve as the main magnet of an isochronous cyclotron. The magnet was designed to be full scale following it to serve as the basis for a complete cyclotron if the specifications were met.

This grant will extend the feasibility study to the design and construction of the necessary subsystems (rf acceleration voltage, ion source extraction system, etc.) to make a functioning cyclotron. Sufficient auxiliary equipment will be provided to allow for extensive studies of the use of beams provided by the accelerator as nuclear probes.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0046, BASIC DIFFERENTIAL SCATTERING CROSS-SECTION MEASUREMENTS USING ION ENERGY-LOSS SPECTROMETRY
J.T. PARK, Univ. of Missouri, School of Science, *Rolla, Missouri* 65401 (PHY74-09671 A04)

A study of the most basic ion-atom collisions in the intermediate energy (15-200 KeV) range is being carried out. Both protons and helium ions are scattered from a target gas of atomic hydrogen. In addition, protons are scattered from helium atoms. Cross sections that are differential in both scattering angle and amount of energy lost in the collisions will be measured. For the target atom, these doubly differential results will yield cross sections for excitation of the target to both the n equals 2 and 3 states as well as ionization cross sections including continuum charge transfer contributions. For the helium ion, differential cross sections for excitation can also be obtained. These cross sections have never been measured before. They are important for both their fundamental theoretical interest and their contributions in plasma interactions.

The measurements are being made on the ion-energy-loss spectrometer at the University of Missouri-Rolla (UMR). This instrument is unique in the 15 to 200 KeV energy range. The measurement technique is not duplicated elsewhere, and most of the cross sections obtained are not accessible with other techniques. The only other cross sections available for the above mentioned processes were measured with the UMR spectrometer, but these were differential in energy loss only. The instrument is now being modified so that doubly differential cross sections can be measured as proposed.

This work is a continuation of that currently supported under NSF grant number PHY74-09671 A03.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0047, SUPERFLUID PHASES OF LIQUID HELIUM-THREE
D.M. LEE, Cornell University, School of Arts & Sciences, *Ithaca, New York* 14853 (DMR76-21669)

This work continues that carried on under NSF Grant No. DMR72-03210. The magnetic properties of the new superfluid phases of liquid helium-3 will be investigated by pulsed and continuous wave nuclear magnetic resonance techniques. The velocity and attenuation of zero sound will be studied in applied magnetic fields. The helium-3 samples will be cooled into the superfluid regions by Pomeranchuk cooling and nuclear adiabatic demagnetization.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0048, INTERACTIONS BETWEEN ELEMENTARY PARTICLES AND NUCLEI, AND DEVELOPMENT OF DETECTION METHODS
W.D. WALKER, Duke University, School of Arts & Sciences, *Durham, North Carolina* 27706 (EY-76-S-05-3065)

We are continuing our work on the study of pion production in pi-nucleus collisions. This work includes a continuation of the study of diffraction dissociation. We should complete our studies of direct electron production in pi-p collisions. This work is very promising in that a good determination of the ratio of single electron to pair production should emerge. We are in the process of starting an experiment using the blocks of Pb-glass obtained on loan from a SLAC-LBL group. The purpose of this experiment will be primarily to study the formation of resonant mesonic states.

RESULTS: We have improved the information available about neutral particle production from positive pion p interactions at intermediate energies. We have determined the pi zero inclusive production properties in some detail and found the eta zero production is suppressed to an unexpectedly low level. These same studies indicate the presence of directly produced photons. We have found some evidence that the known neutral particles may not account for all the energy of the neutral spectrum. Our pi-neon studies have produced interesting results on pion production from nuclei.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of High Energy & Nuclear Physics

8.0049, CRYSTALLINE FIELD ORDERING, QUANTUM DIFFUSION, AND HEAT PULSE PROPAGATION IN SOLID HYDROGEN
J.R. GAINES, Ohio State University, Graduate School, *Columbus, Ohio* 43210 (DMR76-11427 A01)

This is an extension of work carried out under NSF grant no. DMR75-15584. The objectives of the present work are: (a) to measure the temperature dependence of the ratio of the NMR signal arising from molecules in the Mj equals 0 state to the signal arising from molecules in the Mj equals plus 1 state in order to obtain both the sign and magnitude of the crystalline field splitting, (b) to investigate the possibility of a cooperative order-disorder phase transition in solid pH2 containing 1 percent or less OH2 below 0.3 K by means of NMR techniques, (c) to study the propagation of heat pulses in solid H2 as a function of temperature and OH2 concentration, (d) to measure the quantum diffusion rate of OH2 molecules in solid pH2 in the presence of an applied electric field gradient, (e) to prepare films and bulk solid H2 samples by physical vapor deposition and study their properties by NMR and infrared techniques.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0050, DENSITY-FUNCTIONAL THEORY FOR NON-UNIFORM MANY-BODY SYSTEMS
W.F. SAAM, Ohio State University, School of Math. & Phys. Scis., *Columbus, Ohio* 43210 (DMR75-21866 A01)

Research begun under NSF Grant No. DMR 75-21866 will be completed. The density-functional theory for non-uniform systems will be developed and applied to a variety of quantum systems. The theory will be developed for liquid helium-4 at T equals O to treat thin physisorbed films, the electron bubble state, and various positive ion impurity states. It will also be applied for the classical Lennard-Jones systems for the cases of thin films, the nucleation of droplets, and self-trapped electron states in dense gases. Collaborative work with experimentalists will be undertaken.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0051, SURFACE EFFECTS IN YTTRIUM IRON GARNET SINGLE-CRYSTAL FILMS

P.E. WIGEN, Ohio State University, School of Math. & Phys. Scis., *Columbus, Ohio* 43210 (DMR76-14450 A01)

Research supported under NSF grant DMR72-03078 will be continued. In particular, a model proposed to describe surface pinning and the existence of surface spin wave modes will be extended. Microscopic interactions at the surface deemed responsible for the spinning will be investigated and various theoretical possibilities tested experimentally. For these studies, single-crystal epitaxial garnet films will serve as the magnetic surface being investigated.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0052, DESIGN AND STUDY OF NEW FERROELECTRIC ORGANIC POLYMER FILMS AND CRYSTALS

A. GARITO, Univ. of Pennsylvania, School of Arts & Sciences, *Philadelphia, Pennsylvania* 19104 (DA0F1846; DAAK70 77 C 0045)

To synthesize and investigate polymers for pyroelectric, piezoelectric, and non-linear optical properties.

In order to achieve a maximum unit dipole charge on each molecular unit, a parallel sequence of charged dipoles arranged along individual polymer chains, and a parallel stacking of each polymer chain with respect to other chains in the solid, the solid-state polymerization of appropriately substituted diacetylenes will be used. The diacetylenes will have one electropositive and one electronegative substituent to get a maximum push-pull effect.

ADDENDA: Supporting agency address is: ECOM Night Vision Laboratory, (DRSEL-NV-FIR), Ft Belvoir VA 22060

SUPPORTED BY U.S. Dept. of Defense, Army

8.0053, PHOTO-THERMAL CONVERSION OF SOLAR ENERGY

E. EJDER, Univ. of Lund, School of Technology, *Lund 7, Sweden* (53 5562 022)

OBJECTIVE: To develop absorber material with minimal energy loss for converting the sun's rays to usable heat energy.

APPROACH: In stage 1 the proposed project is to be developed and a pilot study/project within the solar power/photophysics sector is to be carried out. This is the second stage of the project.

PROGRESS: In future stages the following examinations are to be carried out: A theoretical and empirical review of the optical properties of suitable semiconductors within the wavelength bands in question. The absorption and emission abilities of homogeneous semiconductors and insulating material with suitable absorption bands within infrared band. The suitability of amorphous materials as absorbers.

SUPPORTED BY National Swedish Board for Energy Source Development

8.0054, AN EXPERIMENTAL STUDY OF SURFACE PROPERTIES OF SOLIDS

D.G. NAUGLE, Texas A & M University System, School of Science, *College Station, Texas* 77843 (A-514)

A new experimental technique to determine the electromagnetic response of a superconducting film by kinetic inductance measurements has been developed and applied to study the properties of amorphous Bi films and the characteristics of a magnetic normal metal-superconductor (mN-S) interface. These experiments indicate that the temperature dependence of the electromagnetic response function may be described by a BCS function with an adjustable parameter a which scales with the average phonon frequency. Further results indicate that the variation of the superconducting order parameter psi at a mN-S interface may be adequately described by the linearized Ginzburg-Landau equations with the boundary condition psi equals O at the interface.

The specific heat of a bulk-like NiO powder with an average particle size of 1300 A and surface area of 7 square meters/gm has been measured from 27 K-300 K. The specific heat for this sample is approximately 2-3 percent higher than that reported by Seltz, et al., over the temperature range from 70 K-300 K. At lower temperatures the measured specific heat is appreciably higher than that calculated by Thompson, et al., from the phonon spectrum determined from inelastic neutron scattering. We have estimated that the surface phonon contribution for this sample is less than 1 percent of the specific heat. Measurements with finer powder samples are in progress.

SUPPORTED BY Robert A. Welch Foundation

8.0055, VIBRATIONAL POTENTIAL FUNCTIONS FOR SMALL MOLECULES

R.W. REDDING, North Texas State University, School of Arts & Sciences, *Denton, Texas* 76203 (B-516)

We have continued our investigation of more accurate methods for calculating the parabolic cylinder function. These functions serve as reference solutions for the zeroth order coupled quadratic wave equations in the diatomic molecule avoid-crossing problem. Previously we reported a method for calculating one member of the pair; we have recently been successful in developing a technique for generating its partner function also. Work is in progress. Work is in progress for incoporating these techniques into the equations for the interaction.

Our work on double-minimum potentials has been extended to include functions which have the two minima at different values of the energy. We have published a study of the effects of a gradual transition from a symmetric to an asymmetric configuration.

SUPPORTED BY Robert A. Welch Foundation

8.0056, NUCLEAR MAGNETIC RELAXATION AND PHASE TRANSITION STUDIES IN RBCAF3

P.P. MAHENDROO, Texas Christian University, School of Arts & Sciences, *Fort Worth, Texas* 76129 (P-451)

We have measured 19F spin-lattice relaxation in RbCaF3 which has a cubic perovskite structure. The measurements were made on two samples at 60 MHz over the temperature range 175 degrees - 350 degrees K. One of the samples has a T1 of 55 sec and the other 200 sec at the ambient temperature. T1 decreases slowly with temperature in both samples and shows a sharp dip around 198 degrees K. This dip is attributed to be an antiferroelectric phase transition which is in good agreement with the birefringence and other experiments. The spin-lattice relaxation time is found to be non-exponential but resolvable into two exponential components. The two relaxation rates can be explained by assuming the formation of regions of correlated fluctuations (called dynamic clusters) possessing the low-temperature phase form above the critical temperature Tc. These cluster formations are associated with the presence of impurities. The non-exponential behavior is more pronounced in our shorter T1 sample than the longer T1 sample. Hence the non-exponential behavior sample can be attributed to the paramagnetic impurities which are higher in the shorter T1 sample. The relaxation mechanisms and anomalous behavior of T1 in relation to the phase transition are investigated.

SUPPORTED BY Robert A. Welch Foundation

8.0057, PHASE TRANSITIONS IN SOLIDS UNDER PRESSURE IN MAGNETIC FIELD

C. CHU, Univ. of Houston, School of Pharmacy, *Houston, Texas* 77004 (DMR77-23204)

Research begun under NSF grant No. DMR73-02660 will be continued and extended. Experimental studies of superconductivity at very high pressures will be made. Techniques have been developed for critical field, susceptibility, specific heat, and resistivity measurements at presssures up to 150 kilobars and temperatures down to 1.2 Kelvin and these techniques will be applied to a wide range of A-15 compounds and the ternary molybdenum chalcogenides. The influence of local atomic disorder on the superconducting transition will be studied in the A-15 compounds. The coexistence of superconductivity amagnetism in the rare earth molybdenum chalcogenides will be studied at high pressures and high magnetic field. As time and resources permit, a study of the metal insulator transition in hydrogen will be undertaken.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0058, STRUCTURE AND BONDING IN AMORPHOUS SEMICONDUCTORS

S.C. MOSS, Univ. of Houston, School of Arts & Sciences, *Houston, Texas* 77004 (E-578)

The structure property relations in a variety of amorphous semiconductors are being studied using electron spin resonance (ESR), optical studies, transport measurements and X-ray diffraction. The principal material studied so far is melanin--a black amorphous organic polymer. The ESR data indicate a large influence of adsorbed water on the (stable) free radical content with an accompanying change of several orders of magnitude in conductivity--showing an increase in surface tension with increasing hydration and a decrease in ESR signal. This is interpreted as an influence of the dielectric medium on the (assumed) hopping barriers which is partially corroborated by correlating such results with the dielectric properties of the adsorbed fluid (water, methanol, and so forth).

Studies are now underway to measure the diffraction pattern with and without water both to resolve the structure of the water in melanin and to note its influence on the as-yet unknown structure of the amorphous solid.

X-ray experiments are also underway on amorphous SiC and TiS2 gel.

SUPPORTED BY Robert A. Welch Foundation

8.0059, SOLID-STATE STUDIES

R.E. WILDE, Texas Technological University, School of Arts & Sciences, *Lubbock, Texas* 79409 (D-148)

An infrared spectroscopic study has shown that GeH4 molecules are situated on one set of sites of CS symmetry in phase IV. The III-IV transition at 63K is apparently a second-order phase transition. In phases II and III the molecules are on sites of C3v or C3 symmetry. The II-III phase transition was observed at 67K. In solid GeD4, phase transitions were observed at 68.5 and 77K. In phases II and III the site symmetry is C1. The II-III phase transition in GeD4 is apparently second order. There is evidence that the v1 vibration of GeD4 is infrared active in the solid state.

SUPPORTED BY Robert A. Welch Foundation

8.0060, APPLICATION OF EQUATION OF MOTION (EOM) METHOD TO ATOMIC AND MOLECULAR STRUCTURE

S.C. PARK, Baylor University, School of Arts & Sciences, *Waco, Texas* 76703 (AA-590)

The present report consists of two parts. In the first part the excitation energies and oscillator strengths for the transitions from ns2 to np2 are studied on the basis of the EOM, or the random phase approximation (RPA). The atoms considered are helium, beryllium, calcium magnesium. The Hartree-Fock wave functions are used as the zeroth approximation to RPA and the results are compared with the earlier results of Altick and Glassgold (AG), who employed either the Hartree or Thomas-Fermi wave functions. The values of the excitation energies are changed little between the two results. The present result shows a major modification in the values of oscillator strengths, however, and in fact give a definite improvement over the values obtained by AG, and comparable with those obtained by elaborate calculation of the configuration interaction.

The same method was also applied to calculate the excitation energies and oscillator strengths of the molecules C2, N2, and C2H4 by employing the widely available minimum basis set of Snyder and Basch as the zeroth approximation. The results obtained using RPA are closer to experimental values than those obtained by Mckoy and his collaborators, who employed more specialized and complicated basis sets. The work is now continued by employing the double-zeta basis, and includes the 2p-2h excitations with renormalized interactions.

SUPPORTED BY Robert A. Welch Foundation

8.0061, THEORETICAL STUDIES IN MANY-BODY PHYSICS

B. SUTHERLAND, Utah Higher Education System, School of Letters & Science, *Salt Lake City, Utah* 84112 (DMR77-08474)

Continuation of research supported by DMR72-05143.

The research will concentrate on two general theoretical topics of high current interest: 1) Soliton physics. This program will focus on the behavior of non-linear fields with symmetric and periodic interaction. The stability of the solutions will be examined and comparisons will be made with other mathematical models which exhibit phase transitions. 2) Exactly soluble models for quantum fluids. This program will deal with solutions of many-body models, such as the Hubbard model and the Wigner crystal. One of the objectives will be to test the validity of many-body approximation schemes on exactly soluble models.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0062, PROPERTIES OF DILUTE MAGNETIC ALLOYS AT VERY LOW TEMPERATURES AND NUCLEAR COOLING

O.G. SYMKO, Utah Higher Education System, School of Letters & Science, *Salt Lake City, Utah* 84112 (DMR76-21702 A01)

Experimental studies of dilute magnetic impurities at very low temperatures previously supported by NSF grant DMR71-01802 will be continued. The interest is in the behavior of transition-metal impurities in a non-magnetic metal host. Such impurities will interact strongly with their surroundings, and in particular they will interact with the crystalline field produced by the surrounding ions and conduction electrons, with the conduction electrons, and with the other impurities; also, hyperfine interactions and a spin-compensated Kondo state can exist. These effects will be studied by measuring the magnetization as a function of temperature in the following alloys: Zn-Cr, Mg-Mn, Au-Mn, and Cu-Cr. As impurity-impurity interactions are quite strong, it will be necessary to go to very low impurity concentrations to observe some of the above mentioned single-impurity effects. The latter tend to be weak and hence low temperatures are necessary to reduce the thermal energy kT. A nuclear cooling apparatus together with a SQUID magnetometer will be used to study the ground-state behavior of some of the above alloys and nuclear quadrupole interactions in metals.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0063, RESEARCH IN THEORETICAL MEDIUM-ENERGY NUCLEAR PHYSICS

J.V. NOBLE, Univ. of Virginia, School of Arts & Sciences, *Charlottesville, Virginia* 22903 (PHY76-84374)

Research in theoretical nuclear physics initiated under NSF grant PHY75-04886 A01 will be continued. Specific topics to be investigated include: 1. Pion-nucleus (Weber), 2. The (pi, N) and N, pi) reactions (Noble, Weber), 3. Baryon resonances in nuclei (Weber), 4. Production of energetic backward-moving fragments (Noble and Weber).

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0064, OPTICAL PROPERTIES OF AEROSOLS

T.J. PEPIN, Univ. of Wyoming, School of Arts & Sciences, *Laramie, Wyoming* 82071 (DN790032; N00019-77-C-0262)

The objective is to study the attenuation of laser light by spherical particles in the one-micron wavelength region.

Develop an optical model for caluclating the volume extinction coefficient for an aerosol medium of hollow glass spheres. Experimentally measure refractive index of the aerosol material and their size distribution. Use optical model to optimize size and type of aerosol for the extinction of 1 micrometer laser radiation.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense, Navy

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, THE RESTORATION OF OBLITERATED SERIAL NUMBERS

R.S. TREPTOW, Chicago State University, School of Arts & Sciences, *Chicago, Illinois* 60628 (NSG 3030)

A technique was discovered at Lewis Research Center of NASA in 1973 for restoring serial numbers obliterated from metal objects, such as firearms and motor vehicles. The unique feature of the technique is that restoration is accomplished by immersing the object in water in a state of ultrasonic cavitation. The resulting etching of the surface is selective and results in restoration of the obliterated number. The principal objectives of the project are to (1) explore variations and optimize procedures in the NASA technique, (2) critically evaluate the technique by comparison to those presently in use and (3) to communicate the results to crime laboratories and other agencies who would benefit.

The project is in the final stages of completion. A manuscript entitled Handbook of Methods for the Restoration of Obliterated Serial Numbers was submitted to NASA and has been favorably reviewed by the law enforcement community. It is in the early stages of publication. Future plans involve distribution of the publication and facilitating the application of its findings by crime laboratories.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

9.0002, CURRICULUM SHARING VIA COMMUNICATIONS TECHNOLOGY SATELLITE (ABBREV)

L. WILLIAMS, North Carolina A & T St. Univ., School of Engineering, *Greensboro, North Carolina* 27411 (NAS 5-24101)

The objective of the Communications Technology Satellite Feasibility Study is to investigate satellite applications aimed at increasing the number of minority scientists and engineers in the USA holding both undergraduate and graduate degrees. It is one of the means of more fully meeting the educational, motivational and inspirational needs of minority youth attending both minority and non-minority institutions of higher education. This objective is to be realized through a motivational and training project utilizing the curriculum sharing, advertising and audio-video communications features of satellites. Current plans include organizing a demonstration experiment involving the Portable Earth Terminal (PET) which is to be located at N.C. A&T State University during the week of February 5th of 1978. It will be a demonstration in curriculum sharing between universities in mass media and Engineering technology. Current conversations are in progress between Mr. Patrick Donoughe, Manager of CTS experiments, NASA Lewis Research Center, Cleveland, Ohio, Mr. Benjamin Smith at NASA Langley Research Center, and others. The type demonstrations, participants and current CTS users who could be used as hosts for the proposed demonstrations are in the process of being determined.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

9.0003, AN ANALYSIS OF METHODS AND TECHNIQUES USED BY GOVERNMENT AGENCIES IN MANAGING INDIRECT COSTS AT MAJOR AEROSPACE FIRMS

C. SAMPSON, State University & Comm. Coll., School of Arts & Sciences, *Nashville, Tennessee* 37203 (NAS 9-15441)

The study will be for a duration of approximately one year and will compare how NASA manages indirect cost with that of other Government agencies, (DOD, ERDA, etc.). It will review the contractors' management systems and focus on the government's management and surveillance of indirect cost of the specific firm. The principal investigator will make a survey of available literature concerning the nature, control and management of indirect cost.

The contractor's indirect cost management system will examine and provide an analysis of: 1. Contractor's indirect cost management system: a. Contractor's indirect budget planning process; b. Techniques employed in development of indirect budgets (i.e., zero base; 'tops' down, combination, etc.); extent of management involvement; c. Contractor's control and indirect cost (tracking system, variance analysis, company management involvement). 2. Government Management and Surveillance of Indirect Cost: a. Systems and techniques employed by government agencies (AF, Navy, ERDA, etc.); b. Location of Government team; c. Numbers and kinds of people performing the function; d. Interface with other government agencies (DOAA, DCAS, etc); e. Types of reviews conducted (frequency, types of people on team, results); f. Types of cost data government obtains (formally submitted/informal access)-cost plans versus internal budget data; g. Negotiation of indirect cost.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, RESEARCH IN COSMIC-RAY PHYSICS

H.S. TORNABENE, Bowie State College, Graduate School, *Bowie, Maryland* 20715 (NGR 21-027-011)

The Study of High-Energy Cosmic Rays by the Detection and Analysis of Atmospheric Cerenkov Optical Radiation from Extensive Air Showers in the Energy Range 2 x 10 to the 12th power to 10 to the 18th power e.v.

The main objectives of this program are: (1) to measure the spatial distribution of atmospheric Cerenkov optical radiation in air showers at sea level, i.e., to measure the light intensity as a function of perpendicular distance from the shower core and also as a function of primary energy; (2) to estimate the primary cosmic-ray nuclear composition as a function of energy as based on the results of objective 01; (3) to observe the energy intensity and time distribution of gamma rays above 10 to 12th power e.v. from the Crab nebula, Cygnus XR I and other sources.

The approach is experimental; a 200 meter square array of 10 detectors at sea level has been used in a series of long exposures to the night sky, including direct-shift scans of the Crab and Cygnus XR 1. Light amplitude and light direction measurements have been made on the order of 10 to the 7th power separate air showers.

Analysis of the data collected, which is in digital form on computer-compatible magnetic tape, is under way. Some early results on the spatial light distribution and chemical composition in the range 10 to the 15th power to 10 to the 16th power e.v. have been finalized and have been published in the Proceedings of the 15th International Cosmic Ray Conference at Plovdiv, Vol. 9, page 156.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0002, THERMODYNAMIC MODELS OF LUNAR METEORITE IMPACT INCORPORATING A TARGET POROSITY PARAMETER

D.E. REHFUSS, Calif. State Univ. & Colleges, School of Science, *San Diego, California* 92115 (NSG 7026)

The general objective of our research is to formulate energy-partitioning models which describe shock heating effects of meteorite impact on the lunar surface. Since a major conjugation with reality is the observation of craters which were prehistorically formed, a necessary corollary of our work is to relate causal meteorite characteristics (size, composition, impact velocity) to the properties (size, proportions) of the crater and to the nature (composition, distribution) of its ejecta blanket.

A current problem of particular concern is that of the wind-transport of ejecta, where the wind under consideration is the transient one existing after an impact which occurs at a sufficiently high velocity that a significant amount of meteorite and target material suffers the vaporization phase change. This transient wind can lead to hyper-ballistic transport of small ejecta particles. An implication is that fine material can travel much farther from its parent crater than has been heretofore expected on the basis of strictly ballistic calculations.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0003, USE OF THE CHAPPUIS BAND FOR DETERMINATION OF MODERN AND HISTORICAL STRATOSPHERIC OZONE LEVELS

R.J. ANGIONE, Calif. State Univ. & Colleges, School of Science, *San Diego, California* 92115 (NSG 1430)

A program is underway to optimize observations and data reduction techniques to use absorption of sunlight by the Chappuis band for the determination of contemporary and historical amounts of ozone in the earth's stratosphere. Observations made by the Smithsonian Institution's Astrophysical Observatory during the period from 1905 to 1955 are being analyzed to produce long-term baselines for Table Mountain, California, and Mount Montezuma, Chile. Shorter length baselines will be determined for seven other sites in North and South America and Africa. Ozone amounts will be reported on an absolute scale that is independent of, but comparable with, results from Dobson spectrophotometry. Modern observations in the wavelength range 0.40 to 0.95 microns will be made of the sun during the daytime with a filter wheel radiometer and of bright stars at night with an existing astronomical telescope and photometer. Data from these observations will be used to optimize the method for ozone detection. To date we have baseline ozone measurements from 1920 to 1950 for Table Mountain, California, and Mount Montezuma, Chile.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0004, ELEMENTS OF SEARCH STRATEGY FOR SETI

C. SEEGER, Calif. State Univ. & Colleges, Graduate School, *San Francisco, California* 94132 (NSG 2210)

It is likely that a significant effort will be underway in the relatively near future, to search for extraterrestrial intelligence (SETI) by scanning the heavens for artificial microwave signals originating far beyond the Solar System. Such an exploration into the almost wholly unknown will be a major departure from the past in the socioscientific area, since one cannot predict with any certainty when the object of the search will be achieved nor what total effort will be required.

Before an acceptable search program can be achieved and launched, it is necessary to synthesize a coherent and detailed set of search strategies which take into account all the pertinent knowledge from relevant scientific and technical disciplines; show the major trade-offs and likely decision points; demonstrate the important cost-benefit choices to be made; and identify the likely en passant spinoffs and rewards of such a venture. The objective of this proposal is to do just this.

This research will take off from the results of the recent works carried out by the Ames Interstellar Communications Study Group and its Science Workshops, in which the author of this proposal was a participant. The principal investigator assumes continued very close cooperation with Ames SETI Program office, which has succeeded the Ames Study Group. No experimental work is contemplated, but modest use of the Ames Research Center computing facilities is indicated.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0005, THREE-DIMENSIONAL NUMERICAL CALCULATIONS RELATED TO STAR FORMATION

C. HAGAR, Calif. State Univ. & Colleges, School of Natural Sciences, *San Francisco, California* 94132 (NCA 2-660703)

In nature, the process of star formation occurs in low temperature, diffuse interstellar clouds and is initiated when in a particular region the force of gravity dominates over all the opposing forces which arise from thermal, turbulent, magnetic, and rotational effects. Mathematical models that follow the collapse of such clouds have been relatively idealized. The most sophisticated calculation that has been made up to the present time treats the effects of gas pressure, rotation, and gravity in a 2-dimensional system that is assumed to be axially symmetric. An important result of these calculations is the formation of a ring-like structure in the interior of the cloud. The ring has been shown, in preliminary numerical calculations including a full three-dimensional treatment of the equations of hydrodynamics, to be unstable to breakup into two or more orbiting components. The objective of this investigation is to perform a full three-dimensional hydrodynamic calculation, including rotation, of the collapse of a cloud in order to determine whether rings are an artifact of the assumption of axial symmetry and whether in this more general treatment, orbiting subcondensations do in fact form. The results have important application to the formation of double star systems and to the formation of planetary systems.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0006, COSMIC-RAY NEUTRON DOSIMETRY

A.B. TUCKER, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NCA 2-675708)

We propose to measure the radiation dose rate from cosmic-ray-produced neutrons at aircraft altitudes. An automated radiation monitoring instrument will be installed on a NASA CV-990 research aircraft. Laboratory techniques will be developed for detecting radioactivity produced by high-energy neutrons in samples carried to high altitudes by the U-2. The scintillation spectrometer developed in 1976 will be flown three times in the C-141. Results will be published in the Journal of Geophysical Research and in Health Physics.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0007, STUDY OF PLANETARY METEOROLOGY

C.A. RIEGEL, Calif. State Univ. & Colleges, School of Natural Sci. & Math., *San Jose, California* 95192 (NSG 2047)

An investigation into the response of the Martian atmosphere to the growth and decay of the polar caps is proposed through the use of a zonally averaged numerical model based on the complete set of hydrodynamic equations. The efficacy of the model is its ability to isolate the baroclinic and mass exchange processes that characterize the polar regions. The results will be used to assess the dust-raising capability of the polar cap winds and to enhance our understanding of general atmospheric processes. A method for improving the estimates of threshold wind speeds is also proposed.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0008, THEORETICAL INVESTIGATIONS OF ISOTOPIC ANOMALY OF XENON IN TERRESTRIAL AND EXTRATERRESTRIAL SAMPLES

D.D. SABU, Grambling State University, Undergraduate School, *Grambling, Louisiana* 71245 (NGR 19-011-012)

The study of the isotopic anomaly of xenon in terrestrial and extraterrestrial samples holds an important clue to the understanding of the early history of our solar system. In the present study we have carried out a theoretical analysis of isotopic anomaly of xenon as observed in meteorites, lunar and terrestrial samples. We have been able to identify and characterize a unique component of xenon which is enriched in both light and heavy isotopes of xenon and is present in most of the carbonaceous chondrites. Possible sources of this component are p- and r-processes occurring at the time of supernova explosion. An important consequence of this observation is that the material out of which our solar system is formed was not completely homogenized prior to the formation of the solar system. Several other elemental isotopic anomalies observed recently in carbonaceous chrondrites support this important conclusion. It is suggested that our solar system may have formed from a single supernova soon after its explosion.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0009, LASER-INDUCED PHOTOLUMINESCENCE STUDIES OF PRIMARY PHOTOCHEMICAL PRODUCTION PROCESSES OF COMETARY RADICALS

W.M. JACKSON, Howard University, School of Liberal Arts, *Washington, District of Columbia* 20001 (NSG 5071)

The principal goal of this research is to understand the primary photochemical processes that lead to radicals that have been observed in comets. A unique vacuum ultraviolet flash lamp system has been designed and is in the process of testing. This flash lamp produces 'tunable vacuum ultraviolet light.' This gives the experimenter the capability to select the wavelength of the dissociating light. The cometary radicals are observed by using a tunable dye laser to excite the fluorescence from individual quantum-state radicals. Using this apparatus, the experimenter may map the photochemical production of individual radicals in well-defined quantum states as a function of the wavelength of the dissociating light. This information may then be used by the cometary theorist to understand the observed radical profiles and emission spectra. The overall system has progressed to the point where tests are now being made using C2N2.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0010, MAGNETIC AND OPTICAL PROPERTIES OF SPACE-RELATED MATERIALS

A.N. THORPE, Howard University, School of Liberal Arts, *Washington, District of Columbia* 20001 (NSG 5186)

Magnetic susceptibility and magnetization measurements as a function of magnetic field intensity (0-100Koe) and temperature (1300-1.5K) are currently being used to study many space-related materials of interest to NASA. Studies are being initiated on the magnetic properties of carbonaceous chondrites, various matrices (copper, etc.) containing dilute amounts of fine iron particles, and probably some of the new tektites from Russia as they become available. Infrared studies of the absorption coefficient at selected wavelength bands is being used in conjunction with the magnetic studies to answer some of the questions concerning these materials, which are of interest because of their relationship to the formation of the earth and other planets.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0011, A LABORATORY STUDY OF THE DIFFUSE REFLECTANCE SPECTRA OF FROSTS AND MINERALS OCCURRING ON ASTRONOMICAL OBJECTS

F.M. GLASER, Pan Amer. University, Graduate School, *Edinburg, Texas* 78539 (NSG 7298)

Measurements of the diffuse reflectance of single-component and polycomponent frosts at a variety of temperatures have been carried out over a wide spectral region. Frosts composed of water, ammonia, carbon dioxide, and hydrogen sulfide have been studied in detail. In some cases, features in the spectra are temperature dependent and can be used as a remote thermometer when the frost is observed on a remote astronomical object, such as a planetary satellite or atmosphereless planet. Spectra of a few mineral powders and frost-covered mineral surfaces have also been obtained. These results simulate the 'dirty snow' seen in the polar regions of Mars and are useful in interpreting the spectrophotometric data of planets, asteroids, and satellites.

The study of the effects of radiation on these materials is now underway. Far ultraviolet photons, electrons, protons, and other charged particles can initiate a variety of chemical and physical reactions in the surface layers of solids. The presence of reaction products can be detected as changes in the reflectance spectrum and perhaps identification of some of the product species can be made from this data alone. In any case, many astronomical objects are subject to ionizing radiation of differing extent. Such measurements are of particular interest in the case of the Galilean satellites as they are subjected to the intense radiation trapped in Jupiter's magnetosphere.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0012, X-RAY DIFFRACTION STUDIES OF SHOCKED LUNAR ANALOGS

R.E. HANSS, St. Marys University, School of Arts & Sciences, *San Antonio, Texas* 78228 (NSG 9039)

THIS PROJECT AIMS: (1) to develop quantitative X-ray diffraction methods for determining the shock pressures experienced by terrestrial lunar analogs involved in cratering processes, and (2) to determine by X-ray diffraction methods the distribution of shock pressures experienced by mineral grains in naturally and artifically shocked samples.

This research utilizes X-ray powder diffractometry (line-broadening studies) and Debye-Scherrer single-grain studies. The samples are lunar analog standards shocked at the Johnson Space Center flat-plate accelerator, nuclear-shocked granodiorite from the Piledriver test in Nevada, and naturally shocked suevite from the Ries Crater in Germany.

Diffractometer standards have been completed for shocked quartz, orthoclase, oligoclase, enstatite, and olivine. A preliminary article on the technique was published in Advances in X-ray Analysis 20, 337-344 (1977). Debye-Scherrer studies of the nuclear-shocked and accelerator-shocked granodiorite are completed, as are about one-half of the naturally shocked Ries samples. We plan to compare all three Debye Scherrer studies in one report.

The next phase of this research will be the application of these methods to determine the distribution of shock pressures around a terrestrial impact crater.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0013, ELECTRON MICROPROBE STUDY OF LUNAR AND PLANETARY ZONED PLAGIOCLASE FELDSPARS

R.K. SMITH, Univ. of Southern Colorado, School of Applied Sci. & Eng., *Pueblo, Colorado* 81001 (NSG 9051)

Compositionally zoned plagioclase feldspars, as members of a continuous reaction series, reflect the external temperature-pressure conditions and bulk composition of a crystallizing silicate melt. Though difficult to interpret, plagioclase zoning is a potentially useful tool for understanding lunar and planetary magmatic processes and recognizing sequences of magmatic events. Because the current understanding of plagioclase zoning is still unsatisfactory a detailed investigation of naturally grown and synthetic grown zoned plagioclases was begun in February 1977.

The present study has consisted of: 1) a detailed petrography of 12 igneous rock thin sections whose plagioclase feldspars contain oscillatory and other types of zoning, and 2) a detailed electron microprobe study of these samples for compositional data. Three zoned plagioclases were selected for analysis by a new technique for collecting and presenting areal electron microprobe data. This new technique utilizes a computerized real-time data collection system that gathers X-ray photon counts from the microprobe spectrometers as the microprobe electron beam scans the specimen surface. After appropriate data processing the computer draws elemental concentration contour maps from two-dimensional data matrices collected for each element.

Current plans include a comparison of the above microprobe data with optical determinations and additional microprobe analyses or synthetic grown zoned plagioclases.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0014, STUDY OF THE EVOLUTION OF SOLAR ACTIVE REGIONS

R.R. KASTEN, Univ. of The Dist. of Columbia, Undergraduate School, *Washington, District of Columbia* 20008 (NCA 5-77)

The purpose of this research is to study the evolution of solar active regions using data obtained with the multichannel spectrograph operated by the Laboratory for Solar Physics and Astrophysics at Sacramento Peak Observatory in Sunspot, New Mexico and the NASA/GSFC OSO-7 EUV spectroheliograph. Contour maps of active regions in as many as 27 different wavelengths, primarily in the visual and near visual, have been made. These maps along with some in the EUV range obtained from satellite observations have been used to develop a morphology of an active region. Work is progressing to analyze the morphology of the same region through a series of nine days. The physical characteristics of the region are also being investigated.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0015, SOLAR RADIATION MEASUREMENT PROJECT

J. IOUP, Xavier University of Louisiana, School of Arts & Sciences, *New Orleans, Louisiana* 70125 (NSG 8050)

It is proposed to obtain measurements of the solar radiation incident at New Orleans. Measurements will be made of the direct solar flux and the total amount of incident solar radiation per day with its distribution in time over the daylight hours. Effects of atmospheric conditions such as cloud cover will be investigated. The reliability and accuracy of instruments such as the shadow ring pyranometer will be tested by comparison with standard equipment. The earth's albedo will be measured as a function of the reflecting surface. Initial measurements will be made at the Xavier campus with future extensions including data taken at various locations throughout the city and surrounding area.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0016, OBSERVATIONS OF DARK CLOUDS AND EMBEDDED SOURCES (INFRARED AND VISUAL PHOTOMETRY AND POLARIMETRY)

G.V. COYNE, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (AST75-16322 A01)

During the past few years interest has grown in the birth of stars in the large dark clouds of gas and dust that occur in the plane of our galaxy. Infrared sensors have enabled astronomers to observe young clusters of stars embedded in these clouds.

The processes by which the clouds fragment and collapse to form stars will be investigated. In particular, the investigation will explore the role of magnetic fields in the clouds by studying the degree of alignment of the dust grains which occur in the clouds. The polarization of the light from stars behind the clouds allows one to study the alignment of the grains. The way in which the polarization varies across the spectrum enables one to estimate the size of the dust grains and the quality of grains is indicated by the amount that the light is reddened.

The methods described above have let astronomers discover there are magnetic fields deep in the interior of clouds and that these fields may be as much as 100 times larger than the general magnetic fields in the galaxy which delineate the spiral arms. Dust grains are growing in the clouds.

These investigations will continue in the expectation that the various bits of data will give us an understanding of the very earliest stages in the life of a star.

This is a continuation of work previously supported by NSF grant AST75 16322.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0017, IMAGE RECONSTRUCTION USING LARGE ASTRONOMICAL TELESCOPES

P.A. STRITTMATTER, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (DF248810; F19628-77-C-0063)

AF function - communications, surveillance, detection, tracking. Deficiency - severe limitation in observing fine spatial details on deep space objects. Objective - to utilize new and existing techniques used in observational stellar astronomy to assist in solving Air Force needs in the areas of satellite identification and monitoring. How research contributes - enables the Air Force to increase spatial resolution through the atmosphere by a factor of over fifty.

A data acquisition system to obtain short-exposure astronomical photographs used in the technique known as 'speckle interferometry'. This system will be used to obtain test and evaluation data on both man-made space objects (satellites) and non-man-made objects (stars, asteroids and extended nebulae). These data will be used to develop and perfect data processing schemes to recover images with spatial detail approaching the best theoretically possible in the absence of atmospheric turbulence.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

10.0018, THEORETICAL INVESTIGATIONS OF X-RAY SOURCES

J. ARONS, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (AST76-18897)

Recent observations of astronomical sources of X-rays from orbiting satellites have revealed a host of new and fascinating astronomical systems. The X-ray sources include neutron stars. A study will be made of the flow of gas as it falls onto a neutron star. It is believed that this gas flow is the energy source for this observed X-ray emission. There will be an examination of the behavior of the X-rays as they stream through the infalling gas. The aim is to find ways in which the properties of the X-rays can be used to measure the intense magnetic forces believed to be present at the surface of these stars. There will be a study of the interaction of galaxies with the intergalactic gas believed to be in galaxy clusters, with the aim of using models of this interaction to determine whether the gas is itself flowing or static. The effects these differences would make for X-ray observations will be examined.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0019, GAS DYNAMICS OF SEMI-DETACHED BINARY SYSTEMS

F.H. SHU, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (AST75-04809 A01)

Theoretical study includes systems as diverse as W Ursae Majoris stars, Algol variables, cataclysmic and binary X-ray sources of low total mass. These provide vivid examples that two stars placed in close proximity produce phenomena which are excitingly different from the sum of the individual behaviors of the separate stellar components. A unified approach is possible

because the common thread which ties together the dynamics and the structure of these systems is the Roche model of close binary stars.

Using the Roche model, the study will include three theoretical problems: (a) the gas dynamics of mass transfer and mass loss in close binaries, (b) the properties of impact-driven accretion disks in semi-detached binaries, and (c) the structure and evolution of contact binaries. Self-consistent models will be constructed, and detailed comparisons with observations will be made.

Prior support was under AST 75-04809.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0020, MICROMETRIC MEASURES OF VISUAL DOUBLE STARS

F. HOLDEN, Unknown Inst. or Indiv. Grant, *California* (AST77-00249)

Support for two additional years will allow continuation of measures, with bifilar micrometers, of visual double stars in California, Chile, and Venezuela. The 36-inch refractor of Lick Observatory will be again available and, in the northern winter when California does not have its best seeing, measures will be made in Chile and Venezuela. The southen observatories of Cerro Tololo and Las Campanas will be visited and also the C.I.D.A. Observatory near Merida, Venezuela, to extend the observations through both hemispheres of the sky.

Double stars are important because they are more numerous than single stars in our galaxy and from their orbital motions information about stellar masses is obtained.

Previous support was by NSF grant AST 75-08831.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0021, THE SUN - A STAR AND A RESOURCE

J.M. MALVILLE, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (SER77-03236)

We propose to develop a new, interdisciplinary course, appropriate for a liberal arts college, involving both solar astronomy and solar energy technology. The course will provide students with a practical knowledge in the design, testing, and utilization of solar equipment as well as an introduction to the nature of the physical processes occurring on and inside the sun. An extensive laboratory program is planned in observational solar astronomy, utilizing a solar laboratory presently under construction by the Department of Astro-Geophysics, and in energy technology. One result of the program will be the writing and testing of a laboratory manual on the topics of the course.

SUPPORTED BY U.S. National Science Foundation, Div. of Science Education Resources Improvement

10.0022, SOLAR CONVECTION AND OBSERVED ATMOSPHERIC MOTION

J. TOOMRE, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (DF248990; F19628-77-C-0104)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate solar disturbance predictions. Objective -determine the mechanism responsible for the generation of solar surface magnetic fields and develop an understanding of the long-term behavior of these fields. How research contributes - a complete model of solar magnetic field generation including dynamo processes will enable long-term predictions of solar activity to be made.

Determine observationally the parameters of observed solar surface motions. From these the properties of the underlying connection and the detailed process of dynamo generation of solar magnetic fields can be deduced. By extending these studies into the chromosphere by using space observations in the uv the mechanisms of magnetic field concentration and subsequent release in flares can be investigated.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

10.0023, INTERSTELLAR MOLECULAR LINE OBSERVATIONS AT 1MM WAVELENGTH USING A JOSEPHSON MIXER

J. EDRICH, Univ. of Denver, Denver Research Institute, *Denver, Colorado* 80210 (AST76-24241)

A mixer receiver for the 220 to 325 GHz range will be developed and optimized. It will be used for observations of interstellar molecular lines. The receiver is based on a Josephson mixer and followed by a low-noise maser with more than 100 MHz bandwidth. New permanent Josephson junctions and a closed cycle refrigerator will be used in order to obtain reliable field operation. Many of the essential components have already been developed and laboratory tested; based on previous results at 47 and 300 GHz a SSB system noise temperature of less than 800 degrees K is predicted.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0024, BALLOON MEASUREMENTS OF THE SOLAR CONSTANT

D.G. MURCRAY, Univ. of Denver, School of Arts & Sciences, *Denver, Colorado* 80210 (ATM76-24263)

The question of the variability of the solar constant is one that has received considerable attention over the years without yielding a definitive answer. Recently the question has been revived by the astronomical measurements of planetary albedos, which seem to indicate a possible variation, and Hickey's satellite measurements, which give a value considerably higher than the value accepted on the basis of early measurements. Since recent climatic studies indicate that small changes in the solar constant could result in significant changes in climate, the question assumes an importance other than just the solar physics implications.

Both of the recent measurements indicate that the solar constant has increased over the last eight years. In each case, however, the change is not significantly above the possible systematic error of the measurement and confirming evidence of the change is needed. In 1968 we made precise measurements of the solar constant based on the solar irradiance measured at 30 kilometers using a balloon-borne pyrheliometer system. The relative accuracy achieved in these measurements was quite good. It is proposed that a balloon flight be performed with this instrumentation at this time. Since the proposed change in the solar constant measured by Hickey greatly exceeds the relative accuracy which can be achieved with this instrumentation, such a flight should determine whether the observed change is real.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0025, PARALLAXES OF NORTHERN AND SOUTHERN STARS

A.P. UPGREN, Wesleyan University, Graduate School, *Middletown, Connecticut* 06457 (AST76-80418)

A systematic difference exists between parallaxes of the same stars observed from the northern and southern hemispheres. It amounts to 0.005 plus or minus 0.001 but its cause is unknown. Such a systematic effect affects the distances of stars which are derived from the parallax measures. This in turn distorts our view of the organization of stars in the sun's neighborhood; and when these distances are extrapolated to more distant objects, it affects our knowledge of the size and shape of our Milky Way Galaxy.

Since the latitudes of the northern and southern observatories used for parallax work differ by more than 60 degrees, an astrometric telescope located near the Equator would be helpful in resolving the systematic difference and identifying its causes. The new 66-cm refracting telescope now in operation near Merida, Venezuela, at latitude 8 degrees 48 minutes N, appears well suited to make parallax observations which could resolve the difference. A parallax program will be undertaken with this telescope, in cooperation with local staff members, beginning with a feasibility study of the optical properties of the instrument. In addition to stars with prior observations from both northern and southern stations, objects of high astrophysical interest south of the celestial equator will be considered for inclusion in the program.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0026, COMPUTER-CONTROLLED MICROPHOTOMETER SYSTEM FOR ASTRONOMICAL RESEARCH

W.F. VANALTENA, Yale University, School of Arts & Sciences, *New Haven, Connecticut* 06520 (AST76-05765)

A versatile, computer-controlled microdensitometer will be installed at Yale University. The system will feature speed and ease of operation, high accuracy, and flexibility.

The microdensitometer will be used to make high precision astrometric measurements of stellar positions and motions. It will also be used for the reduction of both direct and spectral images of stars and galaxies in a number of different studies currently being undertaken at Yale. This facility will be open to use by all interested astronomers.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0027, SPECTROSCOPY AND PHOTOMETRY OF GALAXIES IN FAINT CLUSTERS, USING AN SIT VIDICON DETECTOR

J. KRISTIAN, Carnegie Inst. of Washington, *Washington, District of Columbia* 20005 (AST77-04182)

A program of spectroscopy and two-dimensional photometry of a large sample of faint galaxy clusters and optically faint 3CR radio sources will be continued. These data are fundamental for studies of the evolution of galaxies, of radio sources, and the universe as a whole. The observations will be made with SIT television camera tube detectors which were developed for this project. The emphasis in the cluster program will be on very faint objects and candidates for observations will concentrate on photometry of non-cluster radio galaxies. The research will be discussed with other groups to minimize overlap. The galaxy cluster program will be extended to the Southern Hemisphere using the new 100 inch duPont telescope at Las Campanas Observatory in Chile.

This action provides additional funding and extends the duration of the grant number AST75 16327 for 12 months.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0028, INTERACTION OF HIGH-SPEED SOLAR WIND STREAMS

Y.C. WHANG, Catholic University of America, School of Engin. & Arch., *Washington, District of Columbia* 20017 (ATM75-14991 A01)

This grant is for a two-part study of the corotating high-speed solar wind streams. The first part is to identify the mechanism which can accelerate the solar wind to reach a speed of 600 km s-1 or more at 1 a.u. (astronomical unit). The second part is to study the large-scale interaction of such streams. Under a previous grant (DES 7514991) a quantitative model has been used to identify the expansion of the solar wind in rapidly diverging streamtubes as a mechanism to produce the high-speed solar wind.

The study will use magnetohydrodynamics including the full energy equation for the description of corotating stream structures. The non-linear system of governing equations will be studied by the method of characteristics. Numerical solutions will be obtained to simulate various interaction phenomena such as the overtaking of slow streams by fast streams, the rarefaction and the compression region, and the formation and propagation of interplanetary shocks, and to understand correlations between stream parameters and conditions at the coronal base.

The overall aim of this work is to understand the expansion of the solar atmosphere as it accelerates to the orbit of the earth and beyond.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0029, DETERMINATION OF THE SYSTEMATIC ERRORS AND IMPROVEMENT OF THE SELF-CONSISTENCY OF THE S.A.O.C.

C.A. WILLIAMS, State University of Fla. Sys., School of Natural Sciences, *Tampa, Florida* 33620 (AST75-09732)

Sufficient research has now been done to demonstrate that the systematic errors of a star catalog can be determined from reductions of photographic observations of artificial satellites against a background of the catalog stars. The methods developed so far will be applied to a determination of the systematic errors of the Smithsonian Astrophysical Observatory Catalog, with the primary aim of improving the self-consistency of that catalog.

Data for this investigation have been obtained from measurements of the positions of weather satellites referred to stars on photographs for this purpose by the National Oceanic and Atmospheric Administration. Additional photographs of other satellites obtained by the Smithsonian were used for the determination of the Smithsonian Standard Earth. Data from both series are available for this investigation. The satellite orbit data and the coordinates of the ground stations are available from the same agencies. From the residuals that were obtained in reducing the photographic plates of these satellites, the systematic errors will be determined. An accuracy of about 0.05 arc second is expected in the determination of the self-consistency of the catalog.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0030, REPLACEMENT OF A COMPUTING FACILITY FOR THE LABORATORY FOR ASTROPHYSICS AND SPACE RESEARCH

J.A. SIMPSON, Univ. of Chicago, School of Physical Sciences, *Chicago, Illinois* 60637 (ATM77-15709)

The Laboratory for Astrophysics and Space Research has, since 1958, participated in more than 25 experiments on satellites and space probes and 94 on balloon flights with support from NASA and from NSF. It has performed the processing and analysis of data from those experiments since 1964 in a most economical fashion on an in-house medium-scale computer system, resulting in great economies for the agencies. This system has become obsolete and inadequate to the needs of ongoing experiments in space (i.e., Pioneer 10/11, IMP 7/8) and the new generations of sophisticated experiments on balloons and future spacecraft (e.g., ISEE-C, Spacelab, etc.). It is presenting increasing problems of maintenance due to its age and an increasing lack of parts. The University of Chicago has approved and will underwrite a loan to acquire a replacement computer system by the Laboratory for Astrophysics and Space Research in mid-1977.

This grant will assist the Laboratory in maintaining the cost-effectiveness of its processing and analyses for NSF-supported experiments and to reduce substantially requirements for project funds distributed over at least a 10-year period.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0031, RADIO ASTRONOMICAL RESEARCH IN VERY LONG BASELINE INTERFEROMETRY

G.W. SWENSON, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (AST77-00440)

Research leading to improved techniques in Very Long Baseline Interferometry (VLBI) will be continued. Methods used will include incorporating improved video tape recorders into the existing VLBI network and the use of a communication satellite to permit real-time correlation of VLBI data. The participation of the Vermilion River Radio Observatiory in the VLBI network, providing a badly-needed midwestern station to the interim network of existing telescopes, will also continue. As opportunities permit, a number of galactic hydroxyl (OH) sources will be monitored to observe time-variability on a spatial scale of about one hundredth of an arcsecond.

The University of Illinois contributes to the support of the Vermilion River Radio Observatory.

This is a continuation of work previously supported by NSF grant AST 76-07504.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0032, THEORY OF INTERSTELLAR MEDIUM
W.D. WATSON, Univ. of Illinois, School of Liberal Arts & Sci., *Urbana, Illinois* 61801 (AST73-04781 A01)

Research on the theory of the interstellar medium with an emphasis toward the basic atomic, molecular, and solid-state processes will be carried out. Topics for investigation include isotope fractionation in molecules, atomic and molecular reactions, charge-exchange among atoms, processes relevant to determining the source for heating the interstellar gas, sticking of dust grains in collisions and the kinetics of surface reactions. Close interaction with physicists and chemists in relevant research areas, as well as with observers, will be emphasized.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0033, THE EFFECT OF DIFFERENTIAL ROTATION ON THE SOLAR NEUTRINO FLUX
A.S. ENDAL, Kansas State University, Graduate School, *Manhattan, Kansas* 66502 (AST77-15249)

An investigation will be carried out to test the effects of rotation on neutrino flux emitted from the sun. Loss of angular momentum from the sun and transfer within the interior will be explicitly followed and the effects on the models will be accurately computed with a recently developed evolution code for rotating stars.

Models of the sun will be computed starting with contraction towards the main sequence and continuing to the present age of the sun. Observational data on pre-main-sequence and young main-sequence stars, as well as data on the sun, will be used to check the validity of the results. In addition to testing whether rotation can resolve the solar neutrino discrepancy, the proposed investigation will provide valuable information on the fluid dynamics of the solar interior and the physics of the solar wind.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0034, SPECTROMETER
R.P. CRABBS, Lee Ray Machine Co. Inc., *Baltimore, Maryland* 21208 (DF249970; F19628-75-C-0154)

AF function - environmental impact of high-altitude vehicles. Deficiency - effect of aircraft effluents on solar uv absorption and on ozone. Objective - to determine solar, ultraviolet energy deposition rates and ozone concentrations. How research contributes - energy deposition rates and ozone concentrations will improve models used in computation of environmental impact of Air Force vehicles.

Contractor shall design, fabricate and test a balloon-borne ultraviolet spectrometer for the measurement of solar radiation in the range between 2000 and 3100 Angstroms. After each balloon flight, the instrumentation will be refurbished and prepared for a subsequent flight. Four balloon flights of the solar spectrometer are planned to provide data on the solar spectrum as a function of height in the stratosphere. From these data, energy deposition rates and ozone concentrations will be computed.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LKO, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

10.0035, ANALYSIS AND CATEGORIZATION OF ENERGETIC SOLAR PARTICLE EVENTS
M.A. SHEA, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF248910)

AF function - survivability, solar effects on satellite and missile operations, detection, surveillance, and communications. Deficiency -inability to satisfactorily describe and accurately predict solar and precipitating particle events which affect the aerospace environment in which USAF systems operate. Objective - survey the energetic particle environment that USAF spacecraft and systems experience during operation throughout a solar cycle. To determine the critical factors that control this environment. To identify the potential parameters that are predictors of this environment, and to evaluate and update solar proton prediction techniques. How research contributes - an understanding of the particle population in the environment in which USAF systems operate, and changes thereto, will be obtained with respect to solar cycle variations. The analysis of the particle data, together with correlative and related solar-terrestrial environmental data will be utilized to improve the prediction of critical environmental parameters. This will give increased accuracy and reliability in anticipating system performance and survivability during environmental conditions that can exist during a solar cycle.

Energetic particles accelerated at the sun propagate, through the interplanetary medium and the magnetosphere, impinge on the atmosphere and space vehicles, and significantly affect the e.m. propagation via the ionosphere. Energetic solar particle data acquired by both satellite and ground-based sensors for the past two solar cycles will be acquired and categorized in an effort to delineate the behavior of the particle flux at various times of the solar cycle and under different solar-terrestrial environmental conditions. Analyses will be conducted utilizing these data together with the interplanetary magnetic field and solar wind data with the objective of improving the presently utilized methods for predicting the aerospace environment and consequently the reliability and quality of performance of USAF systems that operate in this environment.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

10.0036, DEVELOPMENT AND EVALUATION OF SCHOTTKY DIODE DETECTORS AND HETERODYNE RADIOMETERS FOR SUBMILLIMETER ASTRONOMICAL STUDIES
H.R. FETTERMAN, Mass. Inst. of Technology, Lincoln Laboratory, *Lexington, Massachusetts* 02173 (AST75-14346 A01)

Detectors for the submillimeter wavelengths are still in a rather primitive state. This program is applying intensive, high-level technology to the fundamental problems of the detection of submillimeter wave signals. The astronomical detection of radiation from large clouds of molecules in interstellar space has enhanced the importance of having good detectors in this spectral region.

The first year has been devoted to the design and fabrication of the various components optimized for specific submillimeter wavelengths; during the second year quantitative measurements will be made on these new components. If necessary, a second round of design and construction will be undertaken. Calibration and sensitivity measurements will be carried out on mixers and receiver systems. The entire submillimeter system will be tested by making simple astronomical observations.

Work on planar devices will continue. Antennas and diodes will be integrated onto wafers, and simple array configurations will be designed, fabricated and tested. Such a monolithic integrated-circuit array shows great promise for use as a large-area coherent detector or as a submillimeter imaging device.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0037, COSMIC-RAY MODULATION USING GROUND-BASED NEUTRON MONITORS AND SPACECRAFT COSMIC-RAY DETECTORS
J.A. LOCKWOOD, Univ. of New Hampshire, School of Technology, *Durham, New Hampshire* 03824 (ATM77-08971)

This grant will support the study of the unusual cosmic-ray modulation during the last solar cycle (20), particularly the 'phase-lag' effects (or hysteresis effects) and the unusual ending of the cycle in 1972-1975. Cosmic-ray data will be drawn from neutron monitors, Pioneer spacecraft cosmic-ray telescopes, solar proton monitoring experiments on the Explorer series, and others. The continued operation of the Mt. Washington neutron monitor will be provided. The first study will be on the cosmic-ray modulation near the minimum in the solar cycle using the Mt. Washington neutron monitor data and satellite and balloon measurements of the primary cosmic radiation at lower energies. Second, an investigation will be made of the off-ecliptic control of the solar modulation and the radial gradient and free-space anisotropies along the interplanetary field direction of the galac-

tic cosmic-rays. Third, a study of the 'phase-lag' effect using neutron monitor and primary cosmic-ray measurements will be made in an attempt to understand the causes of the sudden changes in the modulation that occurred at times such as June, 1969. This will enable a determination of the rigidity dependence and magnitude of the parallel diffusion coefficient. Fourth, an investigation into whether there is a relationship between Forbush decreases and the 11-year variation will be made. Fifth, as these studies proceed, an attempt to refine and add detailed features to the physical model developed for Forbush decreases will be made. Sixth, recalculation of the specific yield functions for neutron monitors using the recent primary cosmic-ray observations which extend to much higher rigidities will be performed.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0038, SOLAR PRESSURE ACCELEROMETER STUDY
M. MELDRUM, Textron Incorporated, *Buffalo, New York* 14205 (DF249540; F19628-77-C-0160)

AF function - airborne navigation, tracking. Deficiency - effect of solar radiation pressure on satellite orbits cannot be predicted with sufficient accuracy. Objective - direct solar pressure measurements with satellite-borne accelerometers. How research contributes - permits accurate determination of Air Force satellite ephemerides.

An electrostatic accelerometer will be flown on the navigation technology satellite NTS-3 for the purpose of accurately measuring solar radiation pressure acting on the spacecraft. An analytical study will be performed to relate the MESA accelerometer capabilities to the specific orbital acceleration environment of NTS-3. The results of this study will be an experiment design which will permit high-accuracy solar pressure measurements.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LK Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

10.0039, BLACK-HOLE PHYSICS AND RELATIVISTIC ASTROPHYSICS
S.A. TEUKOLSKY, Cornell University, School of Arts & Sciences, *Ithaca, New York* 14853 (PHY76-07297 A01)

Research in theoretical general relativity initiated under Foundation grant PHY76-07207 will be continued. Topics to be investigated include: (1) The interaction of black holes with an astrophysical environment; (2) The maximum mass of neutron stars; (3) The interpretation of binary pulsar observations; (4) Rotating, self-gravitating systems in Newtonian gravity; (5) Inhomogeneities in the early Universe and element production.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

10.0040, OBSERVATIONS OF INTERSTELLAR MOLECULES
M.L. KUTNER, Rensselaer Polytechnic Inst., School of Science, *Troy, New York* 12181 (AST76-19834)

An observational program in molecular radio astronomy will be carried out. This program is divided into six basic projects. (A) A study will be made of molecular peaks associated with reflection nebulae to determine the relationship between the peaks and the observed stars. The observations will involve the accurate location of the peaks with respect to the stars, a search for evidence of density increases, and attempts to determine the relationship between the spectral type of the star and the properties of the molecular peak. (B) The relative intensities of the 2-millimeter methanol lines will be used to determine the methanol excitation temperature, independent of any calibration uncertainties. These lines will be mapped to obtain maps of the density variations in the densest parts of molecular clouds. (C) Observations of carbon monoxide will be used to study the large-scale velocity structure, especially rotation, of nearby OB associations, and the motions related to the apparent direction in which star formation progressed through the region. (D) A detailed study is to be made of the dependence of formaldehyde abundance on extinction. This will provide tests of theories of molcular formation. (E) The carbon isotope ratio will be investigated by observation of the 2-millimeter lines of interstellar formaldehyde. (F) Observations will be made to follow up previous searches for interstellar furan, an organic ring molecule.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0041, DETERMINATION OF REVISED MK SPECTRAL TYPES FOR STARS OF TYPES S AND SC
P.C. KEENAN, Ohio State University, School of Arts & Sciences, *Columbus, Ohio* 43210 (AST77-08381)

During the past year a revised classification of cool stars was published by Keenan and McNeil entitled 'Atlas of Spectra of the Cooler Stars, Type G, K, M, S, and C'. This project was supported by the National Science Foundation under grants AST 74-01929 and AST 74-01929A01. Under the present grant stars which have been previously classified as types S and SC will be reclassified consistently on the basis of the revised system developed by Keenan and McNeil. The behavior of some important features in the spectra of these stars will be investigated.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0042, RADIO ASTRONOMICAL OBSERVATIONS OF TWENTY-ONE CENTIMETER ABSORPTION LINES IN QUASI-STELLAR OBJECTS
A.M. WOLFE, Univ. of Pittsburgh, School of Arts & Sciences, *Pittsburgh, Pennsylvania* 15260 (AST76-15202)

Theoretical and observational investigations of redshifted 21 cm absorption lines that form in gas located in front of Quasi-Stellar objects (QSOs) will be carried out. The 21 cm absorption lines are sensitive to local excitation conditions, and can be studied with high angular and spectral resolution. This investigation should help to answer the general question of where absorption-line gas in QSOs is located: near the QSO, or in an intervening galaxy?

It is generally thought that neutral gas intrinsic to a QSO is transparent to 21 cm radiation because of the high spin temperature resulting from the bright 21 cm continuum. The cm-opacity can be appreciable, however, if Lyman alpha (L alpha) photons in sufficient numbers penetrate a layer of neutral hydrogen which has an extremely large L alpha optical depth. A qualitative description of the radiative transfer of L alpha through the layer is given, and a numerical code designed to solve this problem is also described. The code has been tested successfully and answers to the full problem are expected shortly. A calculation investigating the propagation of ionization fronts driven by Lyman continuum radiation emitted by QSOs will be done.

New experiments, using techniques of Very Long Baseline Interferometry, will be done to further elucidate the structure of the absorbing gas. Single-dish radio astronomy experiments to discover 21 cm absorption in low-ionization level clouds will be completed.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0043, DISTANCES AND ABSOLUTE MAGNITUDES OF ECLIPSING BINARY STARS BY THE BARNES-EVANS RELATIONSHIP
D.S. EVANS, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (AST77-01360)

An empirical relationship between the visual surface brightness of stars and the photometric color index V-R will be used to determine distances of a number of double-lined eclipsing binaries. When the actual dimensions of the binary components are available from radial velocities, the intrinsic brightness can be found from the surface brightness derived in turn from the photometric index. Comparison of the true and apparent brightness allows computation of the distance of the stars. Since eclipsing binary systems are found in stellar associations and open star clusters, this method of distance determination, independent of distances from trigonometric parallaxes, can serve as a check on the cosmic distance scale.

Prior support was by NSF grant AST 74-23135 A02.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0044, THE CHEMICAL COMPOSITION OF STARS
D.L. LAMBERT, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (F-634)

Experimental tests of theories of element synthesis in stellar interiors have been conducted with high-resolution photoelectric stellar spectra obtained at the McDonald Observatory. The isotopic abundance ratio 12C/13C has been derived for the atmospheres of about 50 cool stars; absorption lines of the CN and CO molecules have been used. The results are in qualitative agreements with theoretical calculations of 13C production and 12C destruction in the hot stellar interior. In a quantitative comparison, unexplained discrepancies suggest the need for modifications in the theory of element synthesis in these stellar interiors. Current projects include an extension of the chemical composition studies to carbon, nitrogen and oxygen and other elements affected by nuclear processing in stars. Pilot studies of the abundances of magnesium, titanium, and rubidium isotopes have been made using bright stars. The unexpected appearance in August 1975 of the exploding star, Nova Cygni, was exploited. It is hoped that the abundances of the nova synthesized elements C, N and O can be derived. Theoretical calculations have begun of the effect of vibration-rotation interaction on the rotational line strength for electronic and vibration-rotation transitions in diatomic molecules. Accurate RKR potentials are being used.

SUPPORTED BY Robert A. Welch Foundation

10.0045, A MAGNETIC-TAPE CATALOG OF SPECTROSCOPIC AND BIBLIOGRAPHIC STELLAR DATA
S.B. PARSONS, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (AST76-20254)

The Bidelman file of spectroscopic information and references for about 50,000 stars will be put into machine-readable form at the Universiy of Texas. The file covers much of the astronomical literature and contains much unpublished material not available in other major catalogs.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0046, APPLICATION OF HILL'S CURVES TO THE STUDY OF CLASSICAL TRIPLE STELLAR SYSTEMS
V.G. SZEBEHELY, Univ. of Texas, School of Engineering, *Austin, Texas* 78712 (EAR76-19654)

Hill's method of curves of zero velocity discussed in his lunar theory will be extended to the study of the dynamical properties of classical triple stellar systems. His method used in his lunar theory will be generalized to three stellar masses that revolve around each other in the classical configuration: two forming a binary and the third revolving around this double star. Conditions of stability for such astronomically important systems are to be established analytically for any stellar masses, any eccentricities and any semi-major axes. These values will be compared to the observational data of actual stellar systems and the stability of known triple systems investigated. A comparison will also be made with Harrington's results obtained by numerical integration and his results extended to cases not included in his studies. The conditions for stability of arbitrarily high levels of hierarchical systems will be evaluated and applied to Evan's hierarchical system of multiple stars.

SUPPORTED BY U.S. National Science Foundation, Div. of Earth Sciences

10.0047, STUDY OF SELECTED TOPICS IN AURORAL AND EQUATORIAL AERONOMY
B.A. TINSLEY, Univ. of Texas, Inst. for Physical Sciences, *Richardson, Texas* 75080 (ATM77-03335)

This grant funds a program of theoretical and observational research on atmospheric optical and extreme ultraviolet emissions. Work will be done in two principal areas: Alaska and the equator. The Alaskan work consists of a joint observational program with the University of Alaska, using a combination of grille spectrometers and other optical instrumentation. Particular problems relating to emission from heavy ions precipitating in the auroral zone will be pursued. The equatorial work is concerned primarily with the study of optical emissions resulting from the loss of ring current ions due to charge exchange with geocoronal hydrogen.

This work is a continuation of work done on National Science Foundation grants ATM-7417651 and ATM-7519199.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0048, MEASUREMENT OF THE COSMIC-RAY SIDEREAL ANISOTROPY ABOVE 1 TEV
H.E. BERGESON, Utah Higher Education System, School of Science, *Salt Lake City, Utah* 84112 (AST77-07627)

An underground muon detector designed to measure the cosmic-ray sidereal anisotropy at galactic containment energies has been built in a mine near Heber, Utah. Three layers of plastic scintillators, totalling 37.3 m squared each, are located at a mean depth of 4.86 times 10 to the minus 4th power g cm to the minus second power. The median primary cosmic-ray rigidity is 1400 GV for detected events, and the counting rate exceeds 10 to the 8th power yr to the minus 1st power. A computer operates the experiment, performs periodic stability and calibration checks, and is also programmed to search for transient events and narrow-angle temporary anisotropies. The apparatus is complete and essentially operational. Continuous operation is expected in 1977. The sidereal anisotropy of cosmic rays will be measured for the next three years and the results reported.

This action provides additional funding and extends the duration of the grant number AST77 07627 for 24 months.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0049, INVESTIGATION OF LOW-INTENSITY OPTICAL EMISSION LINES FROM THE INTERSTELLAR MEDIUM
F.L. ROESLER, Univ. of Wisconsin, School of Natural Sciences, *Madison, Wisconsin* 53706 (AST77-07840)

A program of observations using a large etalon Fabry-Perot spectrometer to study the spatial structure and ionization state of the faint, diffuse, hydrogen alpha (H alpha) emitting component of the interstellar medium will be carried out. Observations will be made near the directions of O stars that are outside any neutral hydrogen regions visible on the Palomar Sky Survey red plates in order to determine the extent to which such stars ionize the intercloud medium. A study will also be made of an extended region of complex 21-cm filaments, H alpha emission, and soft X-ray emission thought to be associated with a large, expanding super-nova-created cavity. Observations of the line widths, radial velocities, and intensity distribution of the H alpha emission from this region will determine the relationship between the H alpha emitting gas and the expanding neutral hydrogen shell. Observations of other emission lines, such as (NII), (OI) and (OIII), will set limits on the temperature and ionization state of the emitting gas in this as well as other regions of the galactic plane.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

GENERAL

11.0001, SUMMER RESEARCH FELLOWSHIP PROGRAM
G.C. DARDEN, Hampton Institute, Graduate School, *Hampton, Virginia* 23368 (NAS 1-14832)

The main purpose of the Summer Research Fellowship Program is to involve more traditionally black colleges and universities in activities on the National Aeronautics and Space Administration in a way that will strengthen and expand the academic programs of these institutions.

OBJECTIVES OF THE PROGRAM: 1. To foster greater cooperation between participating institutions and the Langley Research Center; 2. To increase the resource base available to the

Langley Research Center for application to its research mission; 3. To expand the academic program at participating institutions.

PARTICIPANTS: The program involves ten persons in research at the Langley Research Center for ten weeks during the summer. Participants are required to write a report of their project which they choose from a list developed by the divisions of the Center. Each participant works with a Center scientist during the summer and has full access to equipment necessary to complete the project.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

11.0002, NASA/MORGAN STATE UNIVERSITY SUMMER FACULTY RESEARCH PROGRAM

N.K. PROCTOR, Morgan State College, Graduate School, *Baltimore, Maryland* 21212 (NGT 21-025-006)

The purpose of this program is to: (1) foster cooperation between participating institutions and GSFC, (2) increase the resources available to Goddard for application to its research mission and (3) benefit the academic process at participating institutions.

Selected faculty members from participating institutions engage in research at GSFC under the supervision of technical monitors from GSFC during a ten-week period during the summer. The following areas of research occupy full time of the participants: Mathematics, Computer Science, Physics, Chemistry, Management Systems, and Mechanical and Electronic Engineering. Staff members from GSFC propose specific problems from the areas listed above. Participants are selected according to their training in one or more of these areas.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

11.0003, INVESTIGATION, IDENTIFICATION, ANALYSIS, AND INTERPRETATION OF NEW POSSIBILITIES IN TRANSFER TECHNOLOGY (ABBREV)

UNKNOWN, Morgan State College, Graduate School, *Baltimore, Maryland* 21212 (NAS 5-23558)

Before technology (as a result of NASA's basic research programs) can be transferred to the public and private sectors, it must first be identified and documented. By interviewing the GSFC personnel who are generating the New Technology, the researcher will retrieve and evaluate ongoing and recently completed research. The analysis and interpretation of the work being done at Goddard will be done by: (a) interviewing the innovators to determine the publishability of the New Technology with respect to use by private industry; (b) assuring that the innovators are informed of the Patent system and how their inventions relate to that system; (c) acquiring all pertinent data for those items with publishable potential; (d) editing and rewriting technical documents to insure the complete and proper descriptions of all appropriate elements; and (e) analyzing and appropriately interpreting the New Technology clause (NASA Form 1162) to all principals involved.

This research is a continuation of what has already been completed during the period June 1, 1976, to May 30, 1977. During that period ten (10) new areas of application were identified, written up, photographed and put into publishable form. Most of these articles have been included in 'Spinoff 1977.'

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

American Institute of Aeronautics and Astronautics

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Every breakthrough in transportation, from the wheel to the jet engine, has brought with it enormous social change. "The Age of Space Transportation" takes a particular look at mankind's next giant step in moving around -- the Space Shuttle, the vehicle itself and its implications. (20 minutes, 16 mm)

For information on obtaining these films, contact:
American Institute of Aeronautics and Astronautics
1290 Avenue of the Americas
New York, N.Y. 10019

VOLUME 16 NUMBER 2 / JANUARY 23, 1978

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N78-10996* + National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 87
Sep. 1977 115 p
(NASA-SP-7037(87)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 368 reports, articles, and other documents introduced into the NASA scientific and technical information system in August 1977. Author

N78-10997 + Royal Aircraft Establishment, Farnborough (England).
THE PUBLICATIONS OF DIETRICH KUECHEMANN
R. W. Slaney, comp. Aug. 1976 24 p refs
(RAE-Lib-Bib-357; BR57421) Copyright. Avail: NTIS HC A02

The publications of Professor Dr. D. Kuechemann, late head of Aerodynamics Department, RAE Farnborough, from 1936 to 1975, are listed in chronological order. They cover all aspects of aerodynamics. ESA

N78-10998*# Goodyear Aerospace Corp., Akron, Ohio.
FEASIBILITY STUDY OF MODERN AIRSHIPS. PHASE 2: EXECUTIVE SUMMARY
Nov. 1977 67 p refs
(Contract NAS2-8643)
(NASA-CR-2922) Avail: NTIS HC A04/MF A01 CSCL 01A

A feasibility study of modern airships has been completed. Three promising modern airship systems' concepts and their associated missions were studied; (1) a heavy-lift airship, employing a non-rigid hull and a significant amount of rotor lift, used for short-range transport and positioning of heavy military and civil payloads, (2) a VTOL (vertical take-off and landing), metalclad, partially buoyant airship used as a short-haul commercial transport; and (3) a class of fully-buoyant airships used for long-endurance Navy missions. The heavy-lift airship concept offers a substantial increase in vertical lift capability over existing systems and is projected to have lower total operating costs per ton-mile. The VTOL airship transport concept appears to be economically competitive with other VTOL aircraft concepts but can attain significantly lower noise levels. The fully-buoyant airship concept can provide an airborne platform with long endurance that satisfies many Navy mission requirements. Author

N78-10999*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LASER VELOCIMETER SYSTEMS ANALYSIS APPLIED TO A FLOW SURVEY ABOVE A STALLED WING
Warren H. Young (Army Air Mobility R and D Lab.), James F. Meyers , and Timothy E. Hepner (Army Air Mobility R and D Lab.) Aug. 1977 159 p refs
(DA Proj. 1F1-61102-A-35A)
(NASA-TN-D-8408; L-11105) Avail: NTIS HC A08/MF A01 CSCL 01A

A laser velocimeter operating in the backscatter mode was used to survey the flow above a stalled wing. Polarization was used to separate the two orthogonal velocity components of the fringe-type laser velocimeter, and digital counters were used for data processing. The velocities of the kerosene seed particles were measured with less than 2 percent uncertainty. The particle velocity measurements were collected into histograms. The flow field survey was carried out above an aspect-ratio-8 stalled wing with an NACA 0012 section. The angle of attack was 19.5 deg, the Mach number was 0.49, and the Reynolds number was 1,400,000. The flow field was characterized by the periodic shedding of discrete vortices from near the crest of the airfoil. Author

N78-11000# Boeing Commercial Airplane Co., Seattle, Wash.
ADHESIVE BONDED AEROSPACE STRUCTURES STANDARDIZED REPAIR HANDBOOK Final Report, 1 Oct. 1975 - 31 Mar. 1976
J. E. McCarty, R. E. Horton, M. C. Locke, M. L. Satterthwait, and B. D. Parashar Dec. 1976 62 p refs
(Contract F33615-73-C-5171; AF Proj. 7381; AF Proj. 1368) (AD-A042384; AFML-TR-76-201; AFFDL-TR-76-131) Avail: NTIS HC A04/MF A01 CSCL 01/3

This report covers the fourth phase of a five-phase program to develop a standardized handbook for the repair of bonded aircraft structures. Tasks include the standardization of small repairs that are now covered by the various aircraft technical orders as well as general instruction for large repair work, including component rebuilding. Work completed in Phase IV included the repair and flight simulation test of an F-111 outboard spoiler. This work will serve as a base for procedures to be designated in the handbook. Author (GRA)

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N78-11001# Indianapolis Center for Advanced Research, Ind. Fluid Dynamics Labs.
THE MODELING OF AN ASYMMETRIC TURBULENT NEAR WAKE USING THE INTERACTION HYPOTHESIS
G. David Huffman and B. Sung-Hong Ng 21 Apr. 1977 43 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Feb. 1978 Prepared in cooperation with Purdue Univ. School of Science, Indianapolis
(Contract F44620-74-C-0065)
Avail: NTIS HC A03/MF A01

A mathematical model for a turbulent near wake was developed within the framework of an interaction hypothesis. The near wake behind an airfoil was treated as a complex turbulent

flow consisting of two neighboring shear layers with distinct but overlapping shear stress profiles of opposite signs. The model utilizes the mean momentum and continuity equations together with two shear stress transport equations derived from the turbulent kinetic energy equation. By relating the shear stresses to the local turbulence quantities, closure for the governing system of equations was achieved without the use of an eddy viscosity or mixing length. The shear stress was therefore no longer required to vanish at the velocity extremum. Author

N78-11002*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL PERFORMANCE OF A 13.65-CENTIMETER-TIP-DIAMETER TANDEM-BLADED SWEPT-BACK CENTRIFUGAL COMPRESSOR DESIGNED FOR A PRESSURE RATIO OF 6

Hugh A. Klassen, Jerry R. Wood (Army Air Mobility Res. and Develop. Lab., Cleveland), and Lawrence F. Schumann (Army Air Mobility Res. and Develop. Lab., Cleveland) Nov. 1977 27 p refs

(NASA-TP-1091) Avail: NTIS HC A03/MF A01 CSCL 01A

A 13.65 cm tip diameter backswept centrifugal impeller having a tandem inducer and a design mass flow rate of 0.907 kg/sec was experimentally investigated to establish stage and impeller characteristics. Tests were conducted with both a cascade diffuser and a vaneless diffuser. A pressure ratio of 5.9 was obtained near surge for the smallest clearance tested. Flow range at design speed was 6.3 percent for the smallest clearance test. Impeller exit to shroud axial clearance at design speed was varied to determine the effect on stage and impeller performance. Author

N78-11003*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF FLAP DEFLECTION ON THE LIFT COEFFICIENT OF WINGS OPERATING IN A BIPLANE CONFIGURATION

J. Stasiak Nov. 1977 38 p refs Transl. into ENGLISH from "Wplyw Wychylenia Klapy na Wspolczynniki Sily Noswej Platow Pracujacych w Ukladzie Dwuplata", Prace Inst. Lotnichtwa, no. 64, 1976 p 5-28 Original language document was announced as A76-41918 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-2790)

(NASA-TM-75059) Avail: NTIS HC A03/MF A01 CSCL 01A

Biplane models with a lift flap were tested in a wind tunnel to study the effect of flap deflection on the aerodynamic coefficient of the biplane as well as of the individual wings. Optimization of the position flap was carried out, and the effect of changes in the chord length of the lower wing was determined for the aerodynamic structure of a biplane with a lift flap on the upper wing. Author

N78-11004*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

F-16 FLUTTER MODEL STUDIES WITH EXTERNAL WING STORES

Jerome T. Foughner, Jr. and Charles T. Bensinger (General Dynamics Corp.) Oct. 1977 17 p refs Presented at the 4th JTCG/MD Aircraft Stores Compatibility Symp., Fort Walton Beach, Fla., 12-14 Oct. 1977

(NASA-TM-74078) Avail: NTIS HC A02/MF A01 CSCL 01A

Results from transonic flutter model studies are presented. The flutter model was constructed to support the flutter prevention and clearance program from preliminary design through flight flutter tests. The model tests were conducted in the Langley transonic dynamics tunnel. The large full span free-flying model was shown to be an effective tool in defining airplane flutter characteristics by demonstrating freedom from flutter for most configurations and by defining optimum solutions for a few troublesome configurations. Author

N78-11005*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PRELIMINARY STUDY OF THE USE OF THE STAR-100 COMPUTER FOR TRANSONIC FLOW CALCULATIONS

James D. Keller and Antony Jameson (New York Univ., N. Y.) Nov. 1977 21 p refs

(NASA-TM-74086) Avail: NTIS HC A02/MF A01 CSCL 01A

An explicit method for solving the transonic small-disturbance potential equation is presented. This algorithm, which is suitable for the new vector-processor computers such as the CDC STAR-100, is compared to successive line over-relaxation (SLOR) on a simple test problem. The convergence rate of the explicit scheme is slower than that of SLOR, however, the efficiency of the explicit scheme on the STAR-100 computer is sufficient to overcome the slower convergence rate and allow an overall speedup compared to SLOR on the CYBER 175 computer. Author

N78-11006*# Michigan Univ., Ann Arbor. Systems Engineering Lab.

MODELS AND TECHNIQUES FOR EVALUATING THE EFFECTIVENESS OF AIRCRAFT COMPUTING SYSTEMS Semiannual Status Report, 1 Nov. 1976 - 30 Apr. 1977

John F. Meyer Jul. 1977 80 p refs

(Grant NsG-1306)

(NASA-CR-145270; SEL-111; SASR-2) Avail: NTIS HC A05/MF A01 CSCL 01A

Models, measures and techniques were developed for evaluating the effectiveness of aircraft computing systems. The concept of effectiveness involves aspects of system performance, reliability and worth. Specifically done was a detailed development of model hierarchy at mission, functional task, and computational task levels. An appropriate class of stochastic models was investigated which served as bottom level models in the hierarchial scheme. A unified measure of effectiveness called 'performability' was defined and formulated. Author

N78-11007*# National Aeronautics and Space Administration, Washington, D. C.

A SURVEY OF COMPUTATIONAL AERODYNAMICS IN THE UNITED STATES

Alfred Gessow and Dana J. Morris 1977 49 p refs

(NASA-SP-394) Avail: NTIS HC A03/MF A01 CSCL 01A

Programs in theoretical and computational aerodynamics in the United States are described. Those aspects of programs that relate to aeronautics are detailed. The role of analysis at various levels of sophistication is discussed as well as the inverse solution techniques that are of primary importance in design methodology. The research is divided into the broad categories of application for boundary layer flow, Navier-Stokes turbulence modeling, internal flows, two-dimensional configurations, subsonic and supersonic aircraft, transonic aircraft, and the space shuttle. A survey of representative work in each area is presented. Author

N78-11008*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF COOLANT FLOW EJECTION ON AERODYNAMIC PERFORMANCE OF LOW-ASPECT-RATIO VANES. 2: PERFORMANCE WITH COOLANT FLOW EJECTION AT TEMPERATURE RATIOS UP TO 2

Jeffrey E. Hass (Army Air Mobility Res. and Develop. Lab., Cleveland) and Milton G. Kofskey Oct. 1977 34 p refs

(NASA-TP-1057; E-9213) Avail: NTIS HC A03/MF A01 CSCL 21E

The aerodynamic performance of a 0.5 aspect ratio turbine vane configuration with coolant flow ejection was experimentally determined in a full annular cascade. The vanes were tested at a nominal mean section ideal critical velocity ratio of 0.890 over a range of primary to coolant total temperature ratio from 1.0 to 2.08 and a range of coolant to primary total pressure ratio from 1.0 to 1.4 which corresponded to coolant flows from 3.0 to 10.7 percent of the primary flow. The variations in primary and thermodynamic efficiency and exit flow conditions with circumferential and radial position were obtained. Author

N78-11009# McDonnell Aircraft Co., St. Louis, Mo.

MULTI JET INDUCED FORCES AND MOMENTS ON VTOL AIRCRAFT HOVERING IN AND OUT OF GROUND EFFECT Final Report, 19 Apr. 1976 - 19 Apr. 1977

Donald R. Kotansky, Norbert A. Durando, Dean R. Bristow, and Philip W. Saunders 19 Jun. 1977 161 p refs

(Contract N62269-76-C-0086)

(AD-A042450; NADC-77229-30) Avail: NTIS HC A08/MF A01 CSCL 01/1

An engineering methodology has been developed for the prediction of propulsive lift system induced aerodynamic effects

for multi-lift-jet VTOL aircraft operating in the hover mode in an out of ground effect. The developed methdology takes into account the effects of aircraft geometry, aircraft orientation (pitch, roll) and height above the ground plane, cross-flow, lift-jet vector directions with respect to the airframe, lift-jet exit flow conditions and noncircular nozzle exit geometry for low aspect ratio nozzles. GRA

N78-11010# Kaman Aerospace Corp., Bloomfield, Conn.
WIND TUNNEL INVESTIGATION OF THE CONTROLLABLE TWIST ROTOR PERFORMANCE AND DYNAMIC BEHAVIOR Final Report, Jun. 1972 - Mar. 1976
A. Z. Lemnios and H. G. Howes Jun. 1977 175 p refs
(Contract DAAJ02-72-C-0092; DA Proj. 1F2-62209-AH-76)
(AD-A042481; R-1487; USAAMRDL-TR-77-10) Avail: NTIS HC A08/MF A01 CSCL 01/3

The Controllable Twist Rotor (CTR) principle is based on a torsionally flexible helicopter blade, utilizing inboard and outboard collective and cyclic controls to optimize the blade pitch distribution along the radius and around the azimuth. The benefits of this unique rotor system include improved performance, delayed retreating-blade stall, and reduced bending moments and vibration levels. GRA

N78-11011# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
AN ANALYSIS OF THE INVISCID TRANSONIC FLOW OVER TWO-ELEMENT AIRFOIL SYSTEMS Interim Report, 19 May 1975 - 31 Dec. 1976
B. Grossman and G. Volpe 1 Jun. 1977 54 p refs
(Contract N00017-75-C-0722)
(AD-A043460; RE-543; ONR-CR215-241-1) Avail: NTIS HC A04/MF A01 CSCL 20/4

This report describes the development of a method for numerically computing the inviscid transonic flow field over an airfoil with a leading-edge slat or a trailing-edge flap. The approach is to solve the full inviscid irrotational flow equations about two-element airfoil systems. The methodology consists of the development of a suitable computational plane and grid system through the application of a series of conformal mappings. The appropriate set of equations and boundary conditions are derived in terms of a smoothly varying, single-valued reduced potential function through analytic removal of all singularities in the computational domain. A stable and accurate relaxation procedure is established for the numerical solution of the governing equations. The method is applied to a variety of transonic supercritical two-element airfoil configurations. Results are presented depicting the surface pressure distribution, streamline patterns in the physical and computational domain, and Mach number contours.
Author (GRA)

N78-11012# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
AN ASSESSMENT OF CIRCULATION CONTROL AIRFOIL DEVELOPMENT Research and Development Report, Jul. 1975 - Sep. 1976
Joseph B. Wilkerson Aug. 1977 57 p refs
(AD-A043826; AERO-1238; DTNSRDC-77-0084) Avail: NTIS HC A04/MF A01 CSCL 20/4

A circulation control (CC) airfoil development program is presented, including an airfoil designation system. Specific performance objectives are set forth as development goals. Background information includes an assessment of state-of-the-art design practices, a comparison of operational requirements with those of conventional airfoils, and a discussion of previous airfoil performance. Selection and design criteria are described for five new CC airfoils. These designs were wind tunnel evaluated as two-dimensional models and a limited amount of airfoil data is shown for comparison to the prior data base. Two of the airfoils were designed with the objective of maintaining high lift augmentation and improving the critical Mach number characteristics, a combination of qualities that was previously nonexistent. Both designs theoretically accomplished the prescribed goals and were validated by experimental results. The development program has advanced the state of the art and nearly doubled the available data base for CC airfoils. Author (GRA)

N78-11013# McDonnell-Douglas Research Labs., St. Louis, Mo.
VISCOUS FLOWFIELDS AND AIRFRAME FORCES INDUCED BY TWO-DIMENSIONAL LIFT JETS IN GROUND EFFECT Interim Technical Report, 1 Feb. 1976 - 28 Feb. 1977
D. R. Kotansky and W. W. Bower 1 Mar. 1977 88 p refs
(Contract N00014-76-C-0494; NR Proj. 215-246; RR0141184)
(AD-A043518; ONR-CR215-246-1) Avail: NTIS HC A05/MF A01 CSCL 20/4

The interaction of the lift jets and the ground is an important consideration with regard to the design of VTOL aircraft. A key element of this ground effect problem is turbulent jet entrainment, which causes otherwise static air to be set into motion and leads to aerodynamic loads on airframe surfaces. As a first step toward gaining an understanding of this phenomenon, a theoretical analysis of two-dimensional (planar) turbulent jet impingement flowfields has been undertaken. Lift jets emanating from flat and curved surfaces jets in close ground effect have been modeled using the the incompressible Reynolds equations in combination with a one-equation turbulence model. Distributions of the flow properties are computed as functions of Reynolds number based on jet exit properties and height of the jet exit plane above ground. Author (GRA)

N78-11014# Aeronautical Research Inst. of Sweden, Stockholm.
A MASS-FLOW PROBE FOR MEASUREMENT IN HIGH-ENTHALPY SUPERSONIC BOUNDARY LAYERS
Gunnar Hovstadius 1977 33 p refs Sponsored by Defence Mater. Admin.
(FFA-128) Avail: NTIS HC A03/MF A01; Almqvist and Wiksell, Stockholm Sw.Kr. 40

A system for mass-flow measurement in supersonic boundary layers was examined. The mass flow is evaluated from measurements of pressure derivatives in a closed volume under controlled temperature conditions. The advantages with respect to previous systems are, mainly, that fewer parameters are involved in the data reduction and that the pressure level in the system can be made arbitrarily low, thereby reducing the risk of detachment of the shock at the probe entrance. It is therefore possible to make measurements closer to the wall than has been possible earlier. Measurements of boundary layer properties were made with the probe side by side with the AVA combined pressure-temperature probe in the FFA Hyp 500 wind tunnel. The mass flows measured with the new system were compared with those calculated from measurements of stagnation temperature and stagnation pressure with the AVA probe. The results agree within the expected limit of accuracy. Author (ESA)

N78-11015# Aeronautical Research Inst. of Sweden, Stockholm.
A COMBINED PROBE FOR MEASUREMENT OF MASS FLOW, STAGNATION TEMPERATURE, AND STAGNATION PRESSURE IN SUPERSONIC BOUNDARY LAYERS
Gunnar Hovstadius 1977 31 p refs
(FFA-129) Avail: NTIS HC A03/MF A01; Almqvist and Wiksell, Stockholm Sw.Kr. 40

A combined probe was built and tested. The mass flow is evaluated from the rate of change of pressure in a volume connected to the probe. The probe incorporates a thermocouple, and provision is made for the establishment of a controlled mass flow past the thermocouple during the temperature measurements. The probe was tested at different pressures and temperatures in the boundary layer on the nozzle wall of the FFA Hyp 500 facilities. Results were compared with those from simultaneous measurements with the AVA combined pressure-temperature probe. The results agreed within the expected limits of accuracy. Author (ESA)

N78-11016# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Entwurfsaerodynamik.
CALCULATION OF THE NONLINEAR COEFFICIENTS OF LOW AND MEDIUM ASPECT RATIO WINGS USING THE VORTEX LATTICE PROCEDURE IN INCOMPRESSIBLE FLOW [BERECHNUNG DER NICHTLINEAREN BEIWERTE VON FLUEGELN MIT KLEINEM UND MITTLEREM SEITENVERHAELTNIS NACH DEM WIRBELLEITERVERFAHREN IN INKOMPRESSIBLER STROEMUNG]

W. Schroeder Dec. 1976 82 p refs In GERMAN
(DLR-IB-151-76/18) Avail: NTIS HC A05/MF A01

A method for the calculation of the nonlinear coefficients of airfoil wings in incompressible symmetrical incident flow, using the principle of the vortex lattice method in which the free discrete leading edge, trailing edge, and lateral edge vortices roll up without force, is described. In extended test calculations the influence of the following numerical stability of the rolling up process was tested: the force-free condition, number of panels and their subdivision into lateral and longitudinal directions, and subdivision of the free vortices in chains of linear vortex fragments. For the favorable parameters found systematic calculations on plane wings with lambda ranging from 0.5 to 5.0 were made. Results for identical wing planforms both with rolled up vortices at the trailing edge and with rolled up vortices at the trailing, lateral, and leading edge are given. ESA

N78-11017# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

UNSTEADY PRESSURE MEASUREMENTS ON WING-STORE COMBINATIONS IN INCOMPRESSIBLE FLOW

Hermann Triebstein 28 Mar. 1977 73 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-426)
(DLR-FB-77-12) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 36,20

Measurements of unsteady pressures on harmonically oscillating wing-store combinations in incompressible flow are dealt with. The measurements were made in a subsonic wind tunnel. The pressure was measured for yaw-, pitch-, and heave-oscillations of the store at different locations of the store in x-, y-, and z-directions. The pitching and yawing oscillations were made about two different axes. Further unsteady pressure distributions were measured on the wing-store combination at harmonically pitching oscillations of the wing and on the store at pitching and heaving oscillations of the store without the wing. Some results were compared with theoretical results. The flow speed was V = 40 m/s and the oscillation frequencies were f = 6, 12 and 20 Hz. Author (ESA)

N78-11018# Poitiers Univ. (France). Centre d'Etudes Aerodynamiques et Thermiques.

TURBULENT SUPERSONIC WAKES [SILLAGES SUPERSONIQUES TURBULENTS]

J. P. Bonnet and R. AlziarydeRoquefort Paris Assoc. Aeron. et Astronautique de France 1977 39 p refs In FRENCH Presented at the 13th Colloq. d'Aerodyn. Appl., Lyon, 8-10 Nov. 1976
(Contract DRME-76/371)
(AAAF-NT-77-06; ISBN-2-7170-0423-8) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

A simple model of compressible turbulent wake was tested experimentally. The experimental setup is detailed and the measurements giving mean values are discussed. The calibration requirements needed for turbulence measurements are described. The measurements were correlated with a mathematical model first constructed for the incompressible case and extended to the compressible case. A fair agreement was found. ESA

N78-11019# Association Aeronautique et Astronautique de France, Paris.

CALCULATION OF THE COMPRESSIBLE BOUNDARY LAYER AROUND A PROFILE [CALCUL DE LA COUCHE LIMITE COMPRESSIBLE AUTOUR D'UN PROFIL]

C. Mari 1977 20 p refs In FRENCH Presented at the 13th Colloq. d'Aerodyn. Appl., Lyon, 8-10 Nov. 1976
(AAAF-NT-77-08; ISBN-2-7170-0425-4) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

An attempt to calculate the compressible boundary layer without insertion of empirical criteria is presented. A one parameter model was constructed based on the Prandtl hypothesis and retaining the friction normal to the wall in the expression of the turbulent kinetic energy. Structural coefficients were introduced to take care of the longitudinal variation of turbulent shear and a fundamental parameter was considered with Gaussian density of probability as a weighting function and based on shear. The Spalding numerical method was used to solve the momentum and enthalpy equations. Applications of the model was performed on cylinders, rectangular wings, and turbocompressor blades in fair agreement with experimental results. ESA

N78-11020# Association Aeronautique et Astronautique de France, Paris.

THEORETICAL AND EXPERIMENTAL STUDY OF SEPARATED BIDIMENSIONAL FLOW AROUND A MOTORCAR PROFILE [ETUDE THEORIQUE ET EXPERIMENTALE DE L'ECOULEMENT BIDIMENSIONNEL DECOLLE AUTOUR D'UN PROFIL DE VEHICULE AUTOMOBILE]

Francis Chometon and Pierre Fontanet 1977 51 p refs In FRENCH Presented at the 13th Colloq. d'Aerodyn. Appl., Lyon, 8-10 Nov. 1976
(AAAF-NT-77-11; ISBN-2-7170-0428-9) Avail: NTIS HC A04/MF A01; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

The rotational wake of an R16 (Renault) automobile was studied. Hydraulic tunnel tests taking into account ground effects were performed using various visualization methods together with velocity and pressure distribution measurements. Data processing studies established that the velocity profiles in the wake belong to one family of universal curves depending on three parameters. A theoretical model is proposed in which the separated flow is represented by a vortical distribution of the curb in the wake, and the results are compared to the experimental values. ESA

N78-11021# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).

EXPERIMENTAL AND THEORETICAL STUDIES ON SEPARATED FLOW AROUND PROFILES [ETUDES EXPERIMENTALES ET THEORIQUES SUR LES DECOLLEMENTS DE PROFILS]

P. Caupenne Paris Assoc. Aeron. et Astronautique de France 1977 43 p refs In FRENCH Presented at the 13th Colloq. d'Aerodyn. Appl., Lyon, 8-10 Nov. 1976
(AAAF-NT-77-13; ISBN-2-7170-0430-0) Avail: NTIS HC A03/MF A01; CEDOCAR, PARIS FF 25 (France and EEC) FF 29 (others)

Current models and experiments dealing with separated flow are reviewed. Both two and three-dimensional flow are considered. ESA

N78-11994# European Space Agency, Paris (France).

QUANTITATIVE HOLOGRAPHIC INTERFEROMETRY IN TWO-DIMENSIONAL TRANSONIC FLOW

Jean Delery, Jean Surget, and Jean-Paul Lacharme *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-2 (ESA-TT-408) Sep. 1977 p 64-95 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977 - 2, Mar.-Apr. 1977 p 89-101 Original report in FRENCH previously announced as A77-32945 (For availability see N78-11991 02-99)
Avail: NTIS HC A09/MF A01

N78-11998# European Space Agency, Paris (France).

HIGHLY CAMBERED BLADES, MOUNTED IN CASCADES AND OSCILLATING IN A FLUID IN TRANSONIC FLOW

Robert Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-2 (ESA-TT-408) Sep. 1977 p 165-172 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-2, Mar.-Apr. 1977 p 129-130 Original report in FRENCH previously announced as A77-32949 (For availability see N78-11991 02-99)
Avail: NTIS HC A09/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N78-11022*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WIND SHEAR MODELING FOR AIRCRAFT HAZARD DEFINITION Interim Report Apr. 1976 - Mar. 1977
Walter Frost (FWG Associates, Inc.) and Dennis W. Camp Mar. 1977 152 p refs
(Contracts NAS8-32217; DOT-FA76WAI-620)
(NASA-CR-155223; AD-A042326/9; FAA-RD-77-36) Avail: NTIS HC A08/MF A01 CSCL 01/2

A discussion of the various types of wind shear which causes problems to aircraft operations is presented. The discussion is limited to low-level wind shear such as could be encountered in the vicinity of airports by by aircraft on approach to landing and on takeoff. The types of shear analyzed are primarily limited to frontal, thunderstorm and shears associated with stable and neutral boundary layers. Modeling of the wind shear for simulation purposes is emphasized. Wind shear is discussed not only as a change in absolute wind speed but also as a result of wind direction change. Some insight is given relative to a combination of wind speed and direction change. It is to be noted that the condition affecting aircraft operations is not one shear parameter but is a combination of several, e.g. horizontal shear, vertical shear, wind direction change and height of shear above ground level. Author

N78-11023*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BASIC ANALYSIS OF TERMINAL OPERATION BENEFITS RESULTING FROM REDUCED VORTEX SEPARATION MINIMA
Leonard Credeur Oct. 1977 25 p refs
(NASA-TM-78624) Avail: NTIS HC A02/MF A01 CSCL 01C

The impact of reducing the wake vortex minimum separation required behind heavy jets on terminal area operation rate was analyzed. The effect on arrival saturation and steady state average delay was determined for various percentages mix of heavy and large jet traffic samples operating under various precision of interarrival spacing. Benefits increase with percentage of heavy aircraft and with precision of control. These results demonstrate the payoff possible from research to reduce the severity of the trailing vortex by aerodynamic means. Author

N78-11024*# General Electric Co., Pittsfield, Mass.
LIGHTNING PROTECTION OF AIRCRAFT
Franklin A. Fisher and J. Anderson Plumer Oct. 1977 530 p refs
(Contract NAS3-19080)
(NASA-RP-1008) Avail: NTIS HC A23/MF A01 CSCL 01C

The current knowledge concerning potential lightning effects on aircraft and the means that are available to designers and operators to protect against these effects are summarized. The increased use of nonmetallic materials in the structure of aircraft and the constant trend toward using electronic equipment to handle flight-critical control and navigation functions have served as impetus for this study. For individual titles, see N78-11025 through N78-11041.

N78-11025*# General Electric Co., Pittsfield, Mass.
THE LIGHTNING ENVIRONMENT
In its Lightning Protect. of Aircraft Oct. 1977 p 1-35 refs (For availability see N78-11024 02-03)
Avail: NTIS HC A23/MF A01 CSCL 01C

Basic characteristics of lightning were studied. Generation and development of the lightning flash were summarized as were lightning polarity and direction. Thunderstorm frequency and lightning flash density were considered and an engineering model of lightning flashes was delineated. B.L.P.

N78-11026*# General Electric Co., Pittsfield, Mass.
AIRCRAFT LIGHTNING ATTACHMENT PHENOMENA
In its Lightning Protect. of Aircraft Oct. 1977 p 37-55 refs (For availability see N78-11024 02-03)
Avail: NTIS HC A23/MF A01 CSCL 01C

An aircraft's influence on lightning-strike occurrence was investigated. The compression of an electric field around an aircraft was considered in mathematical calculations of an aircraft's ability to store charge. Model test results were used to predict lightning-strike attachment zones in an analysis of aircraft design. B.L.P.

N78-11027*# General Electric Co., Pittsfield, Mass.
LIGHTNING STRIKE EXPERIENCE
In its Lightning Protect. of Aircraft Oct. 1977 p 57-74 refs (For availability see N78-11024 02-03)
Avail: NTIS HC A23/MF A01 CSCL 01C

A program implemented to report various lightning-strike incidents was reviewed. Strike incidence data was summarized according to aircraft altitude, flight path, meteorological conditions and atmospheric air temperature. Data was given indicating the incidence of reported lightning strikes to commercial and U.S. Air Force aircraft and an outline of pilot opinion in lightning avoidance was given. B.L.P.

N78-11028*# General Electric Co., Pittsfield, Mass.
LIGHTNING EFFECTS ON AIRCRAFT
In its Lightning Protect. of Aircraft Oct. 1977 p 75-103 refs (For availability see N78-11024 02-03)
Avail: NTIS HC A23/MF A01 CSCL 01C

Direct and indirect effects of lightning on aircraft were examined in relation to aircraft design. Specific trends in design leading to more frequent lightning strikes were individually investigated. These trends included the increasing use of miniaturized, solid state components in aircraft electronics and electric power systems. A second trend studied was the increasing use of reinforced plastics and other nonconducting materials in place of aluminum skins, a practice that reduces the electromagnetic shielding furnished by a conductive skin. B.L.P.

N78-11029*# General Electric Co., Pittsfield, Mass.
DIRECT EFFECTS PROTECTION
In its Lightning Protect. of Aircraft Oct. 1977 p 105-114 refs (For availability see N78-11024 02-03)
Avail: NTIS HC A23/MF A01 CSCL 01C

Protection of an aircraft and each of its various systems against the direct effects of lightning were analyzed. Components located in different sections of the aircraft were individually examined since they are likely to experience different degrees of susceptibility to lightning, and may be vulnerable to different components of the lightning flash. The basic steps to be followed in establishing lightning protection were presented by discussing the varieties of arc entry and current flow-through damage. The lightning-strike zones and lightning current environments are established, since environmental conditions in the zones are those under which specific potective measures must perform. Airworthiness regulations which apply to lightning protection are cited. Author

N78-11030*# General Electric Co., Pittsfield, Mass.
FUEL SYSTEM PROTECTION
In its Lightning Protect. of Aircraft Oct. 1977 p 115-184 refs (For availability see N78-11024 02-03)
Avail: NTIS HC A23/MF A01 CSCL 01C

The hazardous nature of most fuels and the potential for catastrophe if ignition should occur was investigated in regard to the design of adequate lightning protection for aircraft fuel systems. Typical aircraft fuel flammability characteristics and possible ways to control fuel flammability and ignition were reviewed. Guidelines for effective protection of fuel systems were delineated. Author

N78-11031*# General Electric Co., Pittsfield, Mass.
STRUCTURES PROTECTION
In its Lightning Protect. of Aircraft Oct. 1977 p 185-252 refs (For availability see N78-11024 02-03)
Avail: NTIS HC A23/MF A01 CSCL 01C

Materials of which an aircraft is made and the methods used to hold these materials together forming the aircraft structure were studied as factors important in protecting a modern aircraft from hazardous natural environments. Since all-metal aircraft are being replaced by aircraft constructed partly of fiber reinforced plastics with desirable light weight and high strength properties but with poor electrical conductivity, the danger of lightning strikes has become more serious. Lightning effects on metal structures were reviewed and design protection was discussed. The expected

lightning effects on nonmetallic materials such as fiberglass and advanced composites were also reviewed. Author

N78-11032*# General Electric Co., Pittsfield, Mass.
VOLTAGES AND CURRENTS INDUCED BY LIGHTNING
In its Lightning Protect. of Aircraft Oct. 1977 p 253-267 ref
(For availability see N78-11024 02-03)
Avail: NTIS HC A23/MF A01 CSCL 01C

Indirect effects of lightning, the damage to or malfunction of electrical equipment that results from lightning flashes, were considered. These effects range from tripped circuit breakers to computer upset, to physical damage to input or output circuits of electronic equipment. Voltages and currents induced by lightning on the electrical wiring of the aircraft were emphasized regardless of whether or not such voltages and currents cause damage or upset of electrical equipment. Author

N78-11033*# General Electric Co., Pittsfield, Mass.
THE EXTERNAL MAGNETIC FIELD ENVIRONMENT
In its Lightning Protect. of Aircraft Oct. 1977 p 269-292 refs (For availability see N78-11024 02-03)
Avail: NTIS HC A23/MF A01 CSCL 01C

Calculations were made to predict magnetic field intensities surrounding an aircraft following a lightning strike. Aircraft design and aircraft structural geometry were considered in the computations. A wire grid aircraft model was used to aid in magnetic flux estimation. B.L.P.

N78-11034*# General Electric Co., Pittsfield, Mass.
THE INTERNAL MAGNETIC FIELDS CREATED BY DIFFUSION
In its Lightning Protect. of Aircraft Oct. 1977 p 293-327 refs (For availability see N78-11024 02-03)
Avail: NTIS HC A23/MF A01 CSCL 01C

Electrical resistance along with internal and external loop voltages were considered in a calculation of internal magnetic fields observed in aircraft structures following a lightning strike. The geometry of cylindrical bodies, both circular and elliptical, was utilized in the computation in order to model fuselage and wing cross sections. B.L.P.

N78-11035*# General Electric Co., Pittsfield, Mass.
THE INTERNAL FIELDS COUPLED THROUGH APERTURES
In its Lightning Protect. of Aircraft Oct. 1977 p 329-348 refs (For availability see N78-11024 02-03)
Avail: NTIS HC A23/MF A01 CSCL 01C

Magnetic fields coupled through apertures in an aircraft structure were calculated. These fields were shown to be important since some apertures are quite large and since the waveshape of interior fields is not retarded but tends to be the same for small apertures as for that of the external magnetic field. Aperture geometry and reflecting surfaces were considered for computations of field strength and direction. B.L.P.

N78-11036*# General Electric Co., Pittsfield, Mass.
VOLTAGES AND CURRENTS INDUCED ON WIRING
In its Lightning Protect. of Aircraft Oct. 1977 p 349-360 refs (For availability see N78-11024 02-03)
Avail: NTIS HC A23/MF A01 CSCL 01C

Aircraft lightning strikes were investigated in regard to their effects on voltages and currents in aircraft wiring. An electrical conductor's response to magnetic fields and electric fields was examined as part of the voltage and current calculations. The wiring system of the space shuttle was briefly considered as an example. B.L.P.

N78-11037*# General Electric Co., Pittsfield, Mass.
EFFECTS OF SHIELDS ON CABLES
In its Lightning Protect. of Aircraft Oct. 1977 p 361-405 refs (For availability see N78-11024 02-03)
Avail: NTIS HC A23/MF A01 CSCL 01C

Aircraft wiring subjected to rapidly changing electromagnetic fields was considered. The ways in which shielded cables reduce surge voltages were studied along with the ways in which common practice regarding the use of shields may be at variance with the use required for the control of lightning effects. Courses in which this apparent conflict of use may be resolved were suggested. Noise currents flowing on shields of cables related to the noise signals coupled onto signal conductors were also investigated. Author

N78-11038*# General Electric Co., Pittsfield, Mass.
EXAMPLES OF INDUCED VOLTAGES MEASURED ON AIRCRAFT
In its Lightning Protect. of Aircraft Oct. 1977 p 407-427 refs (For availability see N78-11024 02-03)
Avail: NTIS HC A23/MF A01 CSCL 01C

Tests were made on aircraft in which simulated lightning currents were injected into the aircraft and the resultant voltages and currents on the aircraft wiring measured. Aircraft used in the tests were the F-8 aircraft and the F-89J. Author

N78-11039*# General Electric Co., Pittsfield, Mass.
DESIGN TO MINIMIZE INDIRECT EFFECTS
In its Lightning Protect. of Aircraft Oct. 1977 p 429-450 refs (For availability see N78-11024 02-03)
Avail: NTIS HC A23/MF A01 CSCL 01C

Design criteria presented aimed at minimizing or eliminating the indirect effects of lightning. Certain premises were cited on which the criteria were based. Premises indicate that it is desirable to prevent irreversible damage to the aircraft, and that safety of the crew and vehicle is essential. Electronic equipment must be located in regions where the electromagnetic fields produced by lightning are lowest and must be designed with protective shielding. Author

N78-11040*# General Electric Co., Pittsfield, Mass.
COMPONENT DAMAGE ANALYSIS
In its Lightning Protect. of Aircraft Oct. 1977 p 451-493 refs (For availability see N78-11024 02-03)
Avail: NTIS HC A23/MF A01 CSCL 01C

Semiconductor breakdown in aircraft was investigated since lightning strikes induce large current and voltage pulses which may cause failure. Work was done to determine whether or not these voltages and currents cause upset or damage to active or passive components. Failure thresholds were studied extensively and an assessment was made of the vulnerability of a system to a transient environment. Author

N78-11041*# General Electric Co., Pittsfield, Mass.
TEST TECHNIQUES FOR EVALUATION OF INDIRECT EFFECTS
In its Lightning Protect. of Aircraft Oct. 1977 p 495-529 refs (For availability see N78-11024 02-03)
Avail: NTIS HC A23/MF A01 CSCL 01C

Test techniques for evaluation of how well electrical and electronic equipment withstands the indirect effects of lightning were studied. The existing test techniques, and the philosophy behind some of the existing or evolving standards are discussed. Possible avenues of improvement in test techniques are suggested. Author

N78-11042*# Douglas Aircraft Co., Inc., Long Beach, Calif.
STUDY TO DEVELOP IMPROVED FIRE RESISTANT AIRCRAFT PASSENGER SEAT MATERIALS, PHASE 1
Edward L. Trabold 1977 124 p refs
(Contract NAS2-9337)
(NASA-CR-152056) Avail: NTIS HC A06/MF A01 CSCL 01C

The procurement and testing of a wide range of candidate materials is reported. Improved fire resistant nonmetallic materials were subjected to tests to evaluate their thermal characteristics, such as burn, smoke generation, heat release rate and toxicity. In addition, candidate materials were evaluated for mechanical, physical and aesthetic properties. Other properties considered included safety, comfort, durability and maintainability. The fiscal year 1977 and the projected 1980 cost data were obtained for aircraft seat materials. Author

N78-11043# Florida Inst. of Tech., Melbourne. Dept. of Electrical Engineering.
FEDERAL AVIATION ADMINISTRATION: FLORIDA INSTITUTE OF TECHNOLOGY WORKSHOP ON GROUNDING AND LIGHTNING PROTECTION Final Report
May 1977 524 p refs Workshop held at Melbourne, Fla.,

19-21 Apr. 1977
(Contract DOT-FA72WAI-356)
(AD-A043908; FAA-RD-77-84) Avail: NTIS
HC A22/MF A01 CSCL 13/12

The development of the lightning protection industry in the United States, its economic and technical progress, and the industry's use of codes and standards are described. Preferred techniques for grounding electronic equipment and systems for protection from surges induced by lightning, electromagnetic pulses, and other sources are discussed. Author

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N78-11044# Rome Air Development Center, Griffiss AFB, N.Y.
FAA LIGHTNING PROTECTION STUDY: LIGHTNING PROTECTION REQUIREMENTS FOR WILCOX MARK I/D INSTRUMENT LANDING SYSTEM Final Report, May 1976 - Apr. 1977
Marvin D. Drake May 1977 123 p refs
(Contract DOT-FA72WAI-356)
(AD-A043907; RADC/RBC; FAA-RD-77-102) Avail: NTIS
HC A06/MF A01 CSCL 17/7

The degree of susceptibility of the Wilcox Mark I/D to induced electromagnetic pulse effects due to lightning was determined. Protective devices adequate for low voltage electronic systems were proposed. Lightning protection requirements were cited, while types of susceptible components and methods used to determine their withstand capabilities were delineated. Recommendations were made for specific protective devices and circuitry. Author

N78-11045# National Aviation Facilities Experimental Center, Atlantic City, N. J.
SIMULATION MODEL FOR AIR TRAFFIC CONTROL COMMUNICATIONS Final Report
Robert Mulholland Jul. 1977 35 p refs
(FAA Proj. 061-221-100)
(AD-A044256; FAA-RD-77-69; FAA-NA-76-30) Avail: NTIS
HC A03/MF A01 CSCL 17/7

A computer simulation model designed to mimic second-by-second behavior of air/ground communications in an air traffic control sector is described. The model can simulate any one of nine sector functions (e.g., high altitude enroute, low altitude transitional, radar arrival control, etc.). The model exists as a computer program written in the GPSS 5 and FORTRAN 4 languages. Input variables include aircraft arrival rate into sector, distribution of transmission length, distribution of number of transmissions in an air/ground exchange, etc. Response variables include sector aircraft loading, channel utilization, and communications delay. Model output is obtained in the form of time series (e.g., minute-by-minute averages of channel utilization) exhibiting the dynamics of sector communications or simple averages of such series taken over several hours of simulated time. Author

N78-11046# National Aviation Facilities Experimental Center, Atlantic City, N. J.
COLLISION RISK AND ECONOMIC BENEFIT ANALYSIS OF COMPOSITE SEPARATION FOR THE CENTRAL EAST PACIFIC TRACK SYSTEM Final Report, Dec. 1973 - Jun. 1974
Allen C. Busch, Brian Colamosca, and John R. VanderVeer Jun. 1977 144 p refs
(FAA Proj. 012-102-230)
(AD-A044317; FAA-NA-77-32; FAA-EM-77-5) Avail: NTIS
HC A07/MF A01 CSCL 17/7

Criteria for the application of composite separation to the Central East Pacific (CEP) track system were a collision risk and an economic benefit's comparison of the existing four-route and proposed composite six-route systems. Radar data from land-based facilities in California and Hawaii and from Ocean Station Vessel November were processed to determine aircraft navigation performance. Lateral, longitudinal, and composite collision risks were estimated for the existing and proposed composite systems based upon accepted North Atlantic Systems Planning Group (NAT/SPG) methodology, while vertical collision risk was calculated based upon previous NAT/SPG studies. Lateral collision risk for the proposed composite system was found to be lower than for the existing structure. Comparisons of fuel burned and flight times indicated that the proposite composite system are more economically beneficial than the existing route configuration. Author

N78-11047# National Aviation Facilities Experimental Center, Atlantic City, N. J.
ACCURACY TEST OF AN AIR-TO-AIR RANGING AND BEARING SYSTEM Final Report, Jan. - Aug. 1976
Vincent J. Luciani Jun. 1977 24 p
(FAA Proj. 052-241-200)
(AD-A043392; FAA-NA-77-16; FAA-RD-77-59) Avail: NTIS
HC A02/MF A01 CSCL 17/7

The accuracy test is reported of a system designed to measure, display, and record air-to-air range and bearing measurements between in-flight aircraft. Data acquired from flight tests using reference measurements described showed the estimated standard deviation range of error to be 100 feet, reducible to 60 feet via software smoothing of data. The standard deviation of bearing error was 2.4 deg. It was concluded that the system is well within specifications. Author

N78-11048# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Aerospace and Electronics Systems Div.
A COMPUTER STUDY AND SITE ANALYSIS OF THE BUFFALO, NEW YORK RUNWAY 23 GLIDE SLOPE SITE Interim Report, Mar. - Dec. 1974
A. F. Zahorchak Dec. 1974 72 p refs
(Contract DOT-FA74WA-3360)
(AD-A044615; FAA-RD-75-13) Avail: NTIS
HC A04/MF A01 CSCL 17/7

The possibility of achieving Category II performance at Buffalo Runway 23 was investigated. Optimum antenna performance was obtained by compensation, increased coning and the evaluation of terrain effects for each antenna site. These techniques resulted in the probable attainment of Category II performance at Buffalo. Author

N78-11049# INCOSYM, Inc., Calabasa, Calif.
INCOFLEX TWO AXES ACCELEROMETER PROGRAM Final Report, 22 Jun. 1976 - 26 Jul. 1977
J. Russell and R. J. Craig Aug. 1977 43 p refs
(Contract DAAK40-76-C-1025)
(AD-A043610) Avail: NTIS HC A03/MF A01 CSCL 17/7

The purpose of the contract was to build 2 two-axes accelerometers, test them and deliver to the U.S. Army Missile Command. These accelerometers were to be accurate enough for the inertial navigation but were to require no heating or thermal control. This report documents the effort and the test results. GRA

N78-11050# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AWLS OPERATIONAL FLIGHT TEST Final Report, 1 Nov. 1972 - 31 May 1975
Michael J. Lipcsey Jun. 1977 43 p
(AF Proj. 2187)
(AD-A043814; AFFDL-TR-77-39) Avail: NTIS
HC A03/MF A01 CSCL 01/2

This report describes operational aspects and procedures developed for use in the flight testing phase of the all weather landing system program. Included is a brief system description with an outline operational procedure used while making Category III instrument approaches. Problems with present day landing systems and procedures unique to very low visibility operations are brought out, analyzed, and possible improvements suggested. Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N78-11051*# Old Dominion Univ. Research Foundation, Norfolk, Va.

CORRELATION AND ANALYSIS OF ELEVON SEAL TEST RESULTS Final Report

E. G. Keshock Oct. 1977 17 p refs

(Grant NsG-1318)

(NASA-CR-155224) Avail: NTIS HC A02/MF A01 CSCL 01C

The heating rate and pressure distributions in and around the elevon coves were correlated. An analytical approach incorporating such a correlation into a thermal structure computer code to examine the elevon seal and cover structure in flight was developed. Emphasis was placed on the design of a thermal model that predicts gas and wall temperatures in the cove area. The elevon cove area was modelled analytically by a parallel plate flow channel, incorporating effects of axial wall conduction, axial and environmental radiant energy exchanges, and effects of laminar and turbulent convection entrance regions. Comparisons were made between computed and measured values of (1) cove wall temperatures; (2) local gas temperature within the cove; and (3) local heating rates. Author

N78-11052*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EXPERIMENTAL AND ANALYTICAL DETERMINATION OF CHARACTERISTICS AFFECTING LIGHT AIRCRAFT LANDING-GEAR DYNAMICS

Edwin L. Fasanella (Vought Corp., Hampton, Va.), John R. McGehee, and M. Susan Pappas Nov. 1977 46 p refs

(NASA-TM-X-3561; L-11472) Avail: NTIS HC A03/MF A01 CSCL 01C

An experimental and analytical investigation was conducted to determine which characteristics of a light aircraft landing gear influence gear dynamic behavior significantly. The investigation focused particularly on possible modification for load control. Pseudostatic tests were conducted to determine the gear fore-and-aft spring constant, axial friction as a function of drag load, brake pressure-torque characteristics, and tire force-deflection characteristics. To study dynamic tire response, vertical drops were conducted at impact velocities of 1.2, 1.5, and 1.8 m/s onto a level surface; to determine axial-friction effects, a second series of vertical drops were made at 1.5 m/s onto surfaces inclined 5 deg and 10 deg to the horizontal. An average dynamic axial-friction coefficient of 0.15 was obtained by comparing analytical data with inclined surface drop test data. Dynamic strut bending and associated axial friction were found to be severe for the drop tests on the 10 deg surface. Author

N78-11053*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND-TUNNEL TESTS OF WIDE-CHORD TEETERING ROTORS WITH AND WITHOUT OUTBOARD FLAPPING HINGES

William H. Weller (Army Aviat. Res. and Develop. Command, St. Louis, Mo.) and Bill L. Lee Washington Nov. 1977 76 p refs

(DA Proj. 1L2-62209-AH-76)

(NASA-TP-1046; L-11749) Avail: NTIS HC A05/MF A01 CSCL 01C

Wind tunnel tests of aeroelastically designed helicopter rotor models were conducted to obtain rotor aerodynamic performance and dynamic response data pertaining to two-bladed teetering rotors with a wider chord and lower hover tip speed than currently employed on production helicopters. The effects of a flapping hinge at 62 percent radius were also studied. Finally, the effects of changing tip mass on operating characteristics of the rotor with the outboard flapping hinge were examined. The models were tested at several shaft angles of attack for five advance ratios, 0.15, 0.25, 0.35, 0.40, and 0.45. For each combination of shaft angle and advance ratio, the rotor lift was varied over a wide range to include simulated maneuver conditions. At each test condition, rotor aerodynamic performance and dynamic response data were obtained. From these tests, it was found that wide-chord rotors may be subject to large control forces. An outboard flapping hinge may be used to reduce beamwise bending moments over a significant part of the blade radius without significantly affecting the chordwise bending moments. Author

N78-11054# McDonnell Aircraft Co., St. Louis, Mo.

EFFECT OF FIGHTER ATTACK SPECTRUM ON CRACK GROWTH Final Technical Report, May 1975 - Jul. 1976

H. D. Dill and C. R. Saff Wright-Patterson AFB, Ohio AFFDL Mar. 1977 149 p refs

(Contract F33615-75-C-3112)

(AD-A042369; AFFDL-TR-76-112) Avail: NTIS HC A07/MF A01 CSCL 01/3

The purpose of this program was to systematically evaluate the effect of variations in flight stress spectra on crack propagation using current analysis techniques in conjunction with experimental correlations. Over 100 spectra variations were generated, derived from four baseline load factor spectra. The spectra variation types considered were (a) Reordering of loads within a mission, (b) Sequence of missions, (c) Mission mix, (d) Individual length, (e) High and low load truncation, (f) Compression loads, (g) Exceedance curve, (h) Coupling of peaks and valleys, (i) Test limit stress. Crack growth was predicted for each baseline spectrum and spectra variation prior to test with the exception of tests for one baseline spectrum. The generalized Willenborg Model was the primary method of crack growth analysis. Additionally, predictions were made using a closure model based on analyses of crack surface contact. Three constant amplitude and thirty spectrum tests were performed to verify the predictions of the analysis methods, to evaluate the effects of spectra variations, and to provide data useful for defining guidelines for structural verification of future aircraft. Spectrum variations shown to have the greatest impact on crack growth life are those involving modifications of the maximum peak stresses. The experimental data were evaluated and summarized, and recommendations and guidelines were developed for deriving spectra for multi-mission tactical fighter aircraft. GRA

N78-11055# Naval Weapons Support Center, Crane, Ind.

SENSITIVITY OF THE SHOE-BOX IN P001 ANALYSIS

Jerry L. Kemp and Norman L. Parke 23 Jul. 1977 64 p refs

(AD-A043707; NWSC/CR/RDTR-61) Avail: NTIS HC A04/MF A01 CSCL 01/3

Survivability of aircraft against artillery threats can be assessed by a computer program, P001, which assumes that the vulnerable components are all centrally located on the aircraft. This report examines the sensitivity of this assumption and suggests a change to P001 to indicate when the assumption is not valid. Author (GRA)

N78-11056# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Festigkeit von Bauteilen.

PARTS TESTS FOR THE LANDING FLAP SUPPORT OF THE AIRBUS A-300 B [BAUTEILVERSUCHE FUER DEN LANDEKLAPPENTRAEGER DES AIRBUS A 300 B]

D. Wetzel 15 Apr. 1977 38 p refs In GERMAN

(DLR-IB-152-77/07) Avail: NTIS HC A03/MF A01

The guide rails for the landing flap support of the Airbus A-300 B aircraft were tested for replacement of material (steel) by carbon reinforced titanium alloy with a view to an overall parts weight reduction of 16%. Parts tests which allow investigation of the complete landing flap support are described. Results are presented of static, fatigue, and wear tests. Materials tests concerning the joint between the reinforced material and the metallic support were also conducted. ESA

N78-11057# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Festigkeit von Bauteilen.

FATIGUE STRENGTH OF THE UPPER GUIDE RAIL OF THE A-300 NO. 4 LANDING FLAP SUPPORT (TESTS, RESULTS, AND EVALUATION) [SCHWINGFESTIGKEIT DER OBEREN SCHIENE DES LANDEKLAPPENTRAEGERS 4 DES A 300

(VERSUCHSDURCHFUEHRUNG, VERSUCHSERGEBNISSE UND VERSUCHSAUSWERTUNG)]
D. Wetzel 13 May 1977 26 p refs In GERMAN
(DLR-IB-152-77/09) Avail: NTIS HC A03/MF A01

The guide rails for the landing flap support of the Airbus A-300 B aircraft were tested for replacement of material (steel) by carbon fiber reinforced titanium alloy with a view to an overall parts weight reduction of 16 %. Fatigue tests are described for the upper guide rail. Results show an increase in fatigue life over steel rails. ESA

N78-11058# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Festigkeit von Bauteilen.
WEAR AND VIBRATIONAL STRENGTH INVESTIGATIONS ON THE UPPER TRACK, MADE OF Ti A16 V4, OF LANDING FLAP 4 OF THE A 300 B [VERSCHLEISS- UND SCHWINGFESTIGKEITSUNTERSUCHUNGEN AN DER OBEREN SCHIENE AUS Ti A16 V4 DES LANDEKLAPPENTRAEGERS 4 DES A 300 B]
D. Wetzel 24 May 1977 27 p refs In GERMAN
(DLR-IB-152-77/11) Avail: NTIS HC A03/MF A01

Wear and vibration strength tests were made on the landing flap upper track of the European Airbus A-300 B. The rolling contact load tests are described and the results of the tests are presented. It is concluded that the vibrational strength is sufficient under operational loads and that even under extreme wear conditions the limits of operation of the contact surface are not reached. ESA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N78-11059# National Aviation Facilities Experimental Center, Atlantic City, N. J.
SIMULATION OF ORIGINAL AND NAFEC-PROPOSED INTERMITTENT POSITIVE CONTROL COCKPIT DISPLAYS Final Report, Feb. - Jun. 1974
Donald Eldredge, Warren Crook, and Paul Rich Aug. 1977 38 p refs
(FAA Proj. 052-241-200)
(AD-A044199; FAA-NA-77-9) Avail: NTIS HC A03/MF A01 CSCL 01/4

In order to evaluate the adequacy of aircraft proximity warning and collision avoidance information pilot display, 14 alternative cockpit displays were compared to the original Intermittent Positive Control (IPC) BADCOM display in a subjective evaluation by 17 persons. A single display best incorporating the preferred features was then compared to the BADCOM display in a series of simulated midair collisions. The results indicated that there was no overall significant difference between the two displays. However, it was found that the two-altitude sector presentation (NAFEC display) was significantly better than the three-altitude sector presentation (BADCOM display) in terms of pilot performance. In addition to the objective evaluation results, the pilots indicated that they preferred the NAFEC display, because of the positive command approach, and they found the resume navigation command to be important, because it indicated when the threat had passed. Author

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N78-11060 New York Univ., N. Y.
DESIGN OF TRANSONIC CASCADES BY CONFORMAL TRANSFORMATION OF THE COMPLEX CHARACTERISTICS Ph.D. Thesis
Eldon Atkin McIntyre, Jr. 1976 118 p
Avail: Univ. Microfilms Order No. 77-16504

The numerical design of shockless transonic turbine blades is evaluated. More precisely, the problem is to find smooth solutions for the steady irrotational flow of an inviscid fluid about some object in two dimensions. The equations are first cast in linear form by use of the hodograph transformation. The resulting equations, which are of mixed type due to the presence of both subsonic and supersonic regions, are then extended into complex four-space and solved as a characteristic initial value problem. The actual design procedure is to vary the flow parameters until the pattern of streamlines corresponds to flow about a body of reasonable shape. Dissert. Abstr.

N78-11061*# National Aeronautics and Space Administration, Washington, D. C.
AERODYNAMIC INVESTIGATION OF AN AIR-COOLED AXIAL-FLOW TURBINE. PART 2: ROTOR BLADE TIP-CLEARANCE EFFECTS ON OVERALL TURBINE PERFORMANCE AND INTERNAL GAS FLOW CONDITIONS: EXPERIMENTAL RESULTS AND PREDICTION METHODS
A. Yamamoto, K. Takahara, H. Nouse, F. Mimura, S. Inoue, and H. Usui Sep. 1977 84 p refs Transl. into ENGLISH from "Kurei Jikuryū Tabin no Kuryoku Seino ni Kan-Suru Kenkyu', Rept. NAL-TR-466 Natl. Aerospace Lab., Tokyo, Japan, Aug. 1976 p 1-28 Translations were announced as N74-30241 and N75-13273 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-2483)
(NASA-TM-75138) Avail: NTIS HC A05/MF A01 CSCL 21E

Total turbine blade performance was investigated while changing the blade tip clearance in three ways. The internal flow at the moving blade outlet point was measured. Experimental results were compared with various theoretical methods. Increased blade clearance leads to decreased turbine efficiency. Author

N78-11062*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
ADVANCED SUPERSONIC PROPULSION STUDY, PHASE 4 Final Report
R. A. Howlett Sep. 1977 109 p
(Contract NAS3-19540)
(NASA-CR-135273; PWA-5547-4) Avail: NTIS HC A06/MF A01 CSCL 21E

Installation characteristics for a Variable Stream Control Engine (VSCE) were studied for three advanced supersonic airplane designs. Sensitivity of the VSCE concept to change in technology projections was evaluated in terms of impact on overall installed performance. Based on these sensitivity results, critical technology requirements were reviewed, resulting in the reaffirmation of the following requirements: low-noise nozzle system; a high performance, low emissions duct burner and main burner; hot section technology; variable geometry components; and propulsion integration features, including an integrated electronic control system. Author

N78-11063*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AIRCRAFT ENGINE EMISSIONS
Oct. 1977 452 p Conf. held in Cleveland, 18-19 May 1977
(NASA-CP-2021; E-9262) Avail: NTIS HC A20/MF A01 CSCL 21E

A conference on a aircraft engine emissions was held to present the results of recent and current work. Such diverse areas as components, controls, energy efficient engine designs, and noise and pollution reduction are discussed. For individual titles, see N78-11064 through N78-11080.

N78-11064*# Environmental Protection Agency, Washington, D. C.
ENVIRONMENTAL PROTECTION AGENCY AIRCRAFT EMISSIONS STANDARDS
George D. Kittredge *In* NASA. Lewis Res. Center Aircraft Eng. Emissions Oct. 1977 p 1-17 refs (For availability see

N78-11063 02-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

Emissions of air pollutants from aircraft were investigated in order to determine: (1) the extent to which such emissions affect air quality in air quality control regions throughout the United States; and (2) the technological feasibility of controlling such emissions. The basic information supporting the need for aircraft emissions standards is summarized. The EPA ambient air quality standards are presented. Only the primary (health related) standards are shown. Of the six pollutants, only the first three, carbon monoxide (CO), hydrocarbons (HC), and nitrogen oxides, are influenced significantly by aircraft. Author

N78-11065*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EMISSIONS REDUCTION TECHNOLOGY PROGRAM
Robert E. Jones *In its* Aircraft Eng. Emissions Oct. 1977 p 19-58 (For availability see N78-11063 02-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

Combustor concepts having the potential for significantly lower emissions levels were investigated. The combustor emissions reduction was measured in an engine test. Emission characteristics common to all engine classes are shown. Multiple-burning zone combustors, specifically the double-annular and swirl-can combustors were studied. Airblast and air-assist fuel injection techniques were evaluated for emissions control potential. The combustor sceening and refining phases are summarized. Author

N78-11066*# General Electric Co., Philadelphia, Pa. Aircraft Engine Group.
STATUS OF THE NASA/GENERAL ELECTRIC EXPERIMENTAL CLEAN COMBUSTOR PROGRAM, PHASE 3
Donald W. Bahr *In* NASA. Lewis Res. Center Aircraft Eng. Emissions Oct. 1977 p 37-58 (For availability see N78-11063 02-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

The technology required to design and develop advanced commercial, conventional-takeoff-and-landing aircraft engines with significantly lower pollutant exhaust emissions levels than those of current-technology engines was generated and demonstrated. The target pollutant emissions reductions in tests of an advanced commercial aircraft turbofan engine were attained by developing advanced combustor designs. This technology is intended to be applicable to advanced military aircraft engines. The primary focus was on reducing the levels of the gaseous pollutant emissions. Author

N78-11067*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POLLUTION REDUCTION TECHNOLOGY PROGRAM FOR CLASS T4(JT8D) ENGINES
R. Roberts (Pratt and Whitney Aircraft Group, East Hartford, Conn.), A. J. Fiorentino (Pratt and Whitney Aircraft Group, East Hartford, Conn.), and L. A. Diehl *In its* Aircraft Eng. Emissions Oct. 1977 p 29-89 refs (For availability see N78-11063 02-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

The technology required to develop commercial gas turbine engines with reduced exhaust emissions was demonstrated. Can-annular combustor systems for the JT8D engine family (EPA class T4) were investigated. The JT8D turbofan engine is an axial-flow, dual-spool, moderate-bypass-ratio design. It has a two-stage fan, a four-stage low-pressure compressor driven by a three-stage low-pressure turbine, and a seven-stage high-pressure compressor driven by a single-stage high-pressure turbine. A cross section of the JT8D-17 showing the mechanical configuration is given. Key specifications for this engine are listed. Author

N78-11068*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
NASA/PRATT AND WHITNEY EXPERIMENTAL CLEAN COMBUSTOR PROGRAM: ENGINE TEST RESULTS
R. Roberts, A. J. Fiorentino, and W. Greene *In* NASA. Lewis Res. Center Aircraft Eng. Emissions Oct. 1977 p 91-123 refs (For availability see N78-11063 02-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

A two-stage vorbix (vortex burning and mixing) combustor and associated fuel system components were successfully tested in an experimental JT9D engine at steady-state and transient operating conditions, using ASTM Jet-A fuel. Full-scale JT9D experimental engine tests were conducted in a phase three aircraft experimental clean combustor program. The low-pollution combustor, fuel system, and fuel control concepts were derived from phase one and phase two programs in which several combustor concepts were evaluated, refined, and optimized in a component test rig. Significant pollution reductions were achieved with the combustor which meets the performance, operating, and installation requirements of the engine. Author

N78-11069*# Detroit Diesel Allison, Indianapolis, Ind.
POLLUTION REDUCTION TECHNOLOGY PROGRAM FOR TURBOPROP ENGINES
J. G. Tomlinson *In* NASA. Lewis Res. Center Aircraft Eng. Emissions Oct. 1977 p 125-147 refs (For availability see N78-11063 02-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

The reduction of CO, HC, and smoke emissions while maintaining acceptable NO(x) emissions without affecting fuel consumption, durability, maintainability, and safety was accomplished. Component combustor concept screening directed toward the demonstration of advanced combustor technology required to meet the EPA exhaust emissions standards for class P2 turboprop engines was covered. The combustion system for the Allison 501-D22A engine was used, and three combustor design concepts - reverse flow, prechamber, and staged fuel were evaluated. Author

N78-11070*# AiResearch Mfg. Co., Phoenix, Ariz.
POLLUTION REDUCTION TECHNOLOGY PROGRAM FOR SMALL JET AIRCRAFT ENGINES: CLASS T1
T. W. Bruce, F. G. Davis, and H. C. Mongia *In* NASA. Lewis Res. Center Aircraft Eng. Emissions Oct. 1977 p 149-180 ref (For availability see N78-11063 02-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

Small jet aircraft engines (EPA class T1, turbojet and turbofan engines of less than 35.6 kN thrust) were evaluated with the objective of attaining emissions reduction consistent with performance constraints. Configurations employing the technological advances were screened and developed through full scale rig testing. The most promising approaches in full-scale engine testing were evaluated. Author

N78-11071*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUMMARY OF EMISSIONS REDUCTION TECHNOLOGY PROGRAMS
Richard W. Niedzwiecki *In its* Aircraft Eng. Emissions Oct. 1977 p 181-202 (For availability see N78-11063 02-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

The NASA emissions reduction contract programs for EPA aircraft engine classes P2 (turboshaft engines), T1 (jet engines with thrust under 8000 lb), T4 (JT8D) engines), and T2 (jet engines with thrust over 8000 lb) are discussed. The most important aspects of these programs, the commonality of approaches used, the test results, and assessments regarding applications of the derived technology are summarized. Author

N78-11072*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EMISSIONS CONTROL FOR GROUND POWER GAS TURBINES
Richard A. Rudney, Richard J. Priem, Albert J. Juhasz, David N. Anderson, Thaddeus S. Mroz, and Edward J. Mularz *In its* Aircraft Eng. Emissions Oct. 1977 p 203-242 refs (For availability see N78-11063 02-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

The similarities and differences of emissions reduction technology for aircraft and ground power gas turbines is described. The capability of this technology to reduce ground power emissions to meet existing and proposed emissions standards is presented and discussed. Those areas where the developing aircraft gas turbine technology may have direct application to ground power and those areas where the needed technology may be unique to the ground power mission are pointed out. Emissions reduction technology varying from simple combustor modifications to the

use of advanced combustor concepts, such as catalysis, is described and discussed. Author

N78-11073*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

GENERAL AVIATION PISTON-ENGINE EXHAUST EMISSION REDUCTION

Erwin E. Kempke, Jr., William H. Houtman (EPA, Washington, D. C.), William T. Westfield (FAA, Washington, D. C.), Larry C. Duke (AVCO Lycoming, Williamsport, Pa.), and Bernard J. Rezy (Teledyne Continental Motors, Los Angeles) *In its* Aircraft Eng. Emissions Oct. 1977 p 243-275 refs (For availability see N78-11063 02-07)

Avail: NTIS HC A20/MF A01 CSCL 21E

To support the promulgation of aircraft regulations, two airports were examined, Van Nuys and Tamiami. It was determined that the carbon monoxide (CO) emissions from piston-engine aircraft have a significant influence on the CO levels in the ambient air in and around airports, where workers and travelers would be exposed. Emissions standards were set up for control of emissions from aircraft piston engines manufactured after December 31, 1979. The standards selected were based on a technologically feasible and economically reasonable control of carbon monoxide. It was concluded that substantial CO reductions could be realized if the range of typical fuel-air ratios could be narrowed. Thus, improvements in fuel management were determined as reasonable controls. Author

N78-11074*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ALTERNATIVE FUELS

Jack S. Grobman, Helmut F. Butze, Robert Friedman, Albert C. Antoine, and Thaine W. Reynolds *In its* Aircraft Eng. Emissions Oct. 1977 p 277-308 refs (For availability see N78-11063 02-07)

Avail: NTIS HC A20/MF A01 CSCL 21E

Potential problems related to the use of alternative aviation turbine fuels are discussed and both ongoing and required research into these fuels is described. This discussion is limited to aviation turbine fuels composed of liquid hydrocarbons. The advantages and disadvantages of the various solutions to the problems are summarized. The first solution is to continue to develop the necessary technology at the refinery to produce specification jet fuels regardless of the crude source. The second solution is to minimize energy consumption at the refinery and keep fuel costs down by relaxing specifications. Author

N78-11075*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.

SOOT FORMATION IN A TURBULENT SWIRLING FLOW

David P. Hoult *In* NASA. Lewis Res. Center Aircraft Eng. Emissions Oct. 1977 p 309-321 refs (For availability see N78-11063 02-07)

Avail: NTIS HC A20/MF A01 CSCL 21E

The qualitative understanding of soot formation in simple models of gas turbine primary-zone combustors is summarized. Soot formation in flame radiation and air pollution was investigated. Results are presented, namely: (1) if the fuel is premixed with air in approximately stoichiometric proportions, the sequence of states that a fluid element undergoes as it burns is quite different from the sequence when liquid or vapor fuel is injected into an air-flow; (2) swirling flows, as are typical or swirl-can combustors, when burning, can amplify small aerodynamic disturbances upstream of the swirl vanes; and (3) different fuels form significantly different amounts of soot. Each of these effects makes major changes in the amount of soot formed in a given combustor. Author

N78-11076*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

GLOBAL ATMOSPHERIC SAMPLING PROGRAM

Erwin A. Lezberg, Porter J. Perkins, David R. Englund, Daniel J. Gauntner, and James D. Holdeman *In its* Aircraft Eng. Emissions Oct. 1977 p 323-355 refs (For availability see N78-11063 02-07)

Avail: NTIS HC A20/MF A01 CSCL 21E

Automated instruments were installed on a commercial B-747 aircraft, during the program, to obtain baseline data and to monitor key atmospheric constituents associated with emissions of aircraft engines in order to determine if aircraft are contributing to pollution of the upper atmosphere. Data thus acquired on a global basis over the commercial air routes for 5 to 10 years will be analyzed. Ozone measurements in the 29,000 to 45,000 foot altitude were expanded over what has been available from ozonesondes. Limited aerosol composition measurements from filter samples show low levels of sulfates and nitrates in the upper troposphere. Recently installed instruments for measurement of carbon monoxide and condensation nuclei are beginning to return data. Author

N78-11077*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

STRATOSPHERIC CRUISE EMISSION REDUCTION PROGRAM

Larry A. Diehl, Gregory M. Reck, Cecil J. Marek, and Andrew J. Szaniszlo *In its* Aircraft Eng. Emissions Oct. 1977 p 357-391 (For availability see N78-11063 02-07)

Avail: NTIS HC A20/MF A01 CSCL 21E

A recently implemented NASA effort specifically aimed at reducing cruise oxides of nitrogen from high-altitude aircraft is discussed. The desired emission levels and the combustor technology required to achieve them are discussed. A brief overview of the SCERP operating plan is given. Lean premixed-prevaporized combustion and some of the potential difficulties that are associated with applying this technique to gas turbine combustors are examined. Base technology was developed in several key areas. These fundamental studies are viewed as a requirement for successful implementation of the lean premixed combustion technique. Author

N78-11078*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ADVANCED LOW-NO(x) COMBUSTORS FOR SUPERSONIC HIGH-ALTITUDE GAS TURBINES

Peter B. Roberts (International Harvester, Chicago) *In its* Aircraft Eng. Emissions Oct. 1977 p 393-415 ref (For availability see N78-11063 02-07)

Avail: NTIS HC A20/MF A01 CSCL 21E

The impact of gas-turbine-engine-powered aircraft on worldwide pollution was defined within two major areas of contribution. First, the contribution of aircraft to the local air pollution of metropolitan areas and, second, the long-term effects on the chemical balance of the stratosphere of pollutants emitted from future generations of high-altitude, supersonic commercial and military aircraft. Preliminary findings indicate that stratospheric oxides of nitrogen (NOx) emissions may have to be limited to very low levels if, for example, ozone depletion with concomitant increases in sea-level radiation, are to be avoided. Theoretical considerations suggest that (NOx) levels as low as 1.0 gram per kilogram of fuel and less should be attainable from an idealized premixed type of combustor. Experimental rig studies were intended to explore new combustor concepts designed to minimize the formation of (NOx) in aircraft gas turbines and to define their major operational problems and limitations. Author

N78-11079*# California Univ., Berkeley. Dept. of Mechanical Engineering.

LABORATORY STUDIES OF LEAN COMBUSTION

R. F. Sawyer, R. W. Schefer, A. R. Ganji, J. W. Daily, R. W. Pitz, A. K. Oppenheim, and J. W. Angeli *In* NASA. Lewis Res. Center Aircraft Eng. Emissions Oct. 1977 p 417-436 refs (For availability see N78-11063 02-07)

Avail: NTIS HC A20/MF A01 CSCL 21E

The fundamental processes controlling lean combustion were observed for better understanding, with particular emphasis on the formation and measurement of gas-phase pollutants, the stability of the combustion process (blowout limits), methods of improving stability, and the application of probe and optical diagnostics for flow field characterization, temperature mapping, and composition measurements. The following areas of investigation are described in detail: (1) axisymmetric, opposed-reacting-jet-stabilized combustor studies; (2) stabilization through heat recirculation; (3) two dimensional combustor studies; and (4) spectroscopic methods. A departure from conventional combustor design to a premixed/prevaporized, lean combustion configuration is attractive for the control of oxides of nitrogen and smoke

emissions, the promotion of uniform turbine inlet temperatures, and, possibly, the reduction of carbon monoxide and hydrocarbons at idle. Author

N78-11080*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.
EFFECT OF AMBIENT TEMPERATURE AND HUMIDITY ON EMISSIONS OF AN IDLING GAS TURBINE
C. W. Kauffman *In* NASA. Lewis Res. Center Aircraft Eng. Emissions Oct. 1977 p 437-456 refs (For availability see N78-11063 02-07)
Avail: NTIS HC A20/MF A01 CSCL 21E

The effects of inlet pressure, temperature, and humidity on the oxides of nitrogen produced by an engine operating at takeoff power setting were investigated and numerous correction factors were formulated. The effect of ambient relative humidity on gas turbine idle emissions was ascertained. Experimentally, a nonvitiating combustor rig was employed to simulate changing combustor inlet conditions as generated by changing ambient conditions. Emissions measurements were made at the combustor exit. For carbon monoxide, a reaction kinetic scheme was applied within each zone of the combustor where initial species concentrations reflected not only local combustor characteristics but also changing ambient conditions. Author

N78-11081*# General Electric Co., Cincinnati, Ohio.
COST BENEFIT STUDY OF ADVANCED MATERIALS TECHNOLOGY FOR AIRCRAFT TURBINE ENGINES
R. V. Hillery and R. P. Johnston Sep. 1977 89 p refs (Contract NAS3-20074)
(NASA-CR-135235) Avail: NTIS HC A05/MF A01 CSCL 21E

The cost/benefits of eight advanced materials technologies were evaluated for two aircraft missions. The overall study was based on a time frame of commercial engine use of the advanced material technologies by 1985. The material technologies evaluated were eutectic turbine blades, titanium aluminide components, ceramic vanes, shrouds and combustor liners, tungsten composite FeCrAly blades, gamma prime oxide dispersion strengthened (ODS) alloy blades, and no coat ODS alloy combustor liners. They were evaluated in two conventional takeoff and landing missions, one transcontinental and one intercontinental. Author

N78-11082*# Rocketdyne, Canoga Park, Calif.
LINEAR AEROSPIKE ENGINE STUDY Final Report, Jun. 1976 - Apr. 1977
H. G. Diem and F. M. Kirby Nov. 1977 236 p refs (Contract NAS3-20114)
(NASA-CR-135231; RI/RD77-170) Avail: NTIS HC A11/MF A01 CSCL 21A

Parametric data on split-combustor linear engine propulsion systems are presented for use in mixed-mode single-stage-to-orbit (SSTO) vehicle studies. Preliminary design data for two selected engine systems are included. The split combustor was investigated for mixed-mode operations with oxygen/hydrogen propellants used in the inner combustor in Mode 2, and in conjunction with either oxygen/RP-1, oxygen/RJ-5, O2/CH4, or O2/H2 propellants in the outer combustor for Mode 1. Both gas generator and staged combustion power cycles were analyzed for providing power to the turbopumps of the inner and outer combustors. Numerous cooling circuits and cooling fluids (propellants) were analyzed and hydrogen was selected as the preferred coolant for both combustors and the linear aerospike nozzle. The maximum operating chamber pressure was determined to be limited by the availability of hydrogen coolant pressure drop in the coolant circuit. Author

N78-11083# Advisory Group for Aerospace Research and Development, Paris (France).
SECONDARY FLOWS IN TURBOMACHINES
Sep. 1977 304 p In ENGLISH and FRENCH Presented at the 49th meeting of the AGARD Propulsion and Energetics Panel held at The Hague, Netherlands, 28-30 Mar. 1977
(AGARD-CP-214; ISBN-92-835-0199-3) Avail: NTIS HC A14/MF A01

The consensus of research which was presented suggested that (1) simplified secondary vortivity considerations and pseudo-boundary layer approaches seem to be promising for multistage compressor analysis if backed by experimental results, (2) this analysis seems to be inadequate for turbines and fully three-dimensional calculation methods must be used. These are still time consuming but are certainly less expensive than experiments, and (3) new experimental techniques must be used, in spite of cost and effort, to provide the necessary flow models. However, experiments must be carefully planned. For individual titles, see N78-11084 through N78-11104.

N78-11084 Salford Univ. (England).
RECENT DEVELOPMENTS IN SECONDARY FLOW
J. H. Horlock *In* AGARD Secondary Flows in Turbomachines Sep. 1977 18 p refs (For availability see N78-11083 02-07)
Avail: NTIS HC A14/MF A01

The 'state-of-the-art' in secondary flow work was reviewed. Major recent developments include: (1) clarification of earlier work on the inviscid analysis of secondary flows, (2) a new emphasis on Beltrami flows (flows with uniform stagnation pressure but streamwise vorticity), (3) integration of boundary layer calculations with inviscid secondary flow analyses, (4) full three dimensional flow calculations, both inviscid and viscid, and (5) improvements in correlations of secondary losses. Author

N78-11085 Ecole Centrale de Lyon, Ecully (France). Laboratoire de Mecanique des Fluides.
CALCULATIONS CONCERNING THE SECONDARY FLOWS IN COMPRESSOR BLADINGS
F. Leboeuf, A. Comte, and K. D. Papailiou *In* AGARD Secondary Flows in Turbomachines Sep. 1977 9 p refs (For availability see N78-11083 02-07)
Avail: NTIS HC A14/MF A01

The behavior of secondary flows in compressors is analyzed using an integral method of calculation based on MELLOR's theory and a radial equilibrium calculation method. The comparison of the theory with the experiment is finally discussed. Author

N78-11086 Ecole Centrale de Lyon, Ecully (France).
EXPERIMENTAL STUDY OF THE BEHAVIOR OF SECONDARY FLOWS IN A TRANSONIC COMPRESSOR
G. Bois, F. Leboeuf, A. Comte, and K. D. Papailiou *In* AGARD Secondary Flows in Turbomachines Sep. 1977 20 p refs (For availability see N78-11083 02-07)
Avail: NTIS HC A14/MF A01

Detailed measurements in the secondary flow regions in a transonic one-stage compressor have been transformed for different values of the inlet boundary layer and tip clearance. The behavior of the secondary flows is examined in the light of these measurements. Author

N78-11087 Technische Hochschule, Aachen (West Germany).
SECONDARY FLOWS AND ANNULUS WALL BOUNDARY LAYERS IN AXIAL-FLOW COMPRESSOR AND TURBINE STAGES
H. E. Gallus and W. Kuemmel *In* AGARD Secondary Flows in Turbomachines Sep. 1977 15 p refs (For availability see N78-11083 02-07)
Avail: NTIS HC A14/MF A01

The complex interdependencies of the various loss sources in axial turbomachines require very complicated correlations in the prediction of the total losses. Thus, it is worth proving how the total losses can be predicted by more simplified and idealized loss models. In this paper, an appropriate method is presented. In a first attempt, this method is demonstrated by the calculation of only three essential loss components in an axial-flow compressor stage and their comparison with the measured total losses. The loss components taken into account are: profile losses, losses by the collateral wall boundary layer, and a certain part of losses caused by secondary flows. In the stator of the axial compressor stage mentioned before, systematical measurements in the casing wall boundary layer were performed. Some results such as streamline patterns, pressure distributions and velocity profiles are presented. At last, experimental investigations aiming at the reduction of secondary flow losses in an axial-flow turbine stage are dealt with. A considerable reduction was achieved by boundary layer grooves or fences for the very small aspect ratio of 0.25. Author

N78-11088 Texas A&M Univ., College Station. Gas Turbine Laboratories.
SECONDARY FLOWS IN AXIAL FLOW COMPRESSORS WITH TREATED BLADES
Meherwan P. Boyce *In* AGARD Secondary Flows in Turbomachines Sep. 1977 14 p refs (For availability see N78-11083 02-07)
Avail: NTIS HC A14/MF A01

As a means of increasing the performance and surge margin of axial flow compressors, boundary layer control in many forms have to be applied. A technique is described which controls the flow in the separation- region. The technique deals with the treatment of the suction surface of the blade. The overall goals of the program were to extend the surge-to-stall margin; and to accomplish this, an extensive test program of flow visualization was conducted, using a different cascade model. These results were then compared with various theoretical models to understand the complex flow field in an axial compressor. The results indicate that blade treatment is effective in controlling the onset of surge, and thus increases the surge-to-stall margin by creating a stable flow situation. Author

N78-11089 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
INFLUENCE OF INITIAL DISTORTIONS ON SECONDARY FLOWS IN A FIXED ANNULAR CASCADE
Jacques Huard *In* AGARD Secondary Flows in Turbomachines Sep. 1977 7 p refs In FRENCH; ENGLISH summary (For availability see N78-11083 02-07)
Avail: NTIS HC A14/MF A01

A test rig comprising, in a cylindrical duct of constant height, an accelerating cascade that provided a girating flow at high subsonic Mach number and a receiving cascade representing the downstream stator of an axial compressor deflecting the flow back to the axial direction was used for the experimental study. In the reference configuration, the flow is uniform in azimuth at inlet. By means of angular sectors of screens with different permeabilities, a pressure drop is created upstream of the first cascade. The exploration of the flow between the two cascades reveals a strong perturbation near the hub, where the azimuthal variation of the tangential component induces the transformation of the flow, whose static pressure was initially variable in both radius and azimuth, into one with only radial pressure variation. It is this flow that impinges the decelerating cascade, which amplifies the secondary affects near the hub, where intense flow separations take place. A strong amplification of initial flow distortions has thus been brought to light, as regards secondary flows. Author

N78-11090 Vrije Universiteit, Brussels (Belgium). Dept. of Fluid Mechanics.
HOT-WIRE MEASUREMENTS IN AN AXIAL COMPRESSOR AND CONFRONTATION WITH THEORETICAL PREDICTIONS OF SECONDARY FLOWS
J. De Ruyck, Ch. Hirsch, and P. Kool *In* AGARD Secondary Flows in Turbomachines Sep. 1977 18 p refs (For availability see N78-11083 02-07)
Avail: NTIS HC A14/MF A01

Measurements of the three-dimensional flow field behind a single stage compressor rotor are presented and a brief description of the measurement technique is given. Components of vorticity are extracted from the experimental data and compared with secondary flow theory. Author

N78-11091 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
DUAL BEAM LASER ANEMOMETRY STUDY OF THE FLOW FIELD IN A TRANSONIC COMPRESSOR
H. B. Weyer and R. Dunker *In* AGARD Secondary Flows in Turbomachines Sep. 1977 11 p refs (For availability see N78-11083 02-07)
Avail: NTIS HC A14/MF A01

An advanced laser anemometer (L-2-F-technique) was used to study in detail the internal flow of a transonic axial flow compressor at tip Mach numbers of 0.9 and 1.4 (corresponding to 70 and 100% speed). This investigation having yielded quite complete data on the span- and gap-wise velocity profiles reveals a good survey on the real flow pattern even in the high-speed transonic rotor: detailed informations are available on the flow deceleration at subsonic and supersonic inlet velocities, on the 3-dimensional shock-waves, on transition phenomena from subsonic to supersonic flow along the blade height, on blade wakes, and flow unsteadiness. Experimental results are applied to a discussion of primary characteristics of transonic rotor flow. Author

N78-11092 Imperial Chemical Industries, Wilton (England).
SECONDARY FLOW AND LOSSES IN TURBINE CASCADES WITH INLET SKEW
H. B. Carrick *In* AGARD Secondary Flows in Turbomachines Sep. 1977 21 p refs (For availability see N78-11083 02-07)
Avail: NTIS HC A14/MF A01

A skewed boundary layer was produced upstream of an impulse turbine cascade, using a moving belt. Measurements of the flow field upstream, downstream and within the cascade passage were made with pressure probes. Typical results for total pressure, velocity and static pressure are presented, and the effect of the skewed inlet boundary layer on the secondary losses and flow pattern within the cascade is discussed. Three numerical methods were used to calculate the endwall flow field, a passage averaged boundary layer method, a three-dimensional boundary layer method for a cascade passage, and a three-dimensional inviscid method. Typical results of these methods are displayed and their advantages and disadvantages discussed. Author

N78-11093 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EFFECTS OF SECONDARY FLOWS IN STRAIGHT CASCADES
Georges Meauze *In* AGARD Secondary Flows in Turbomachines Sep. 1977 6 p refs In FRENCH; ENGLISH summary (For availability see N78-11083 02-07)
Avail: NTIS HC A14/MF A01

Secondary flows in straight cascades play a considerable role, and jeopardize the validity of the tests performed on this experimental set-up, especially at high compression rates, when the secondary flow may fill a relatively important part of the interblade channels. In order to palliate this difficulty, a system of lateral boundary layer suction has been developed. It permits the elimination of the secondary flow and the definition of a primary flow practically uniform over the whole cascade width. The results obtained are satisfactory in subsonic, transonic and supersonic flow, with or without simulation of section convergence. Author

N78-11094 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
SECONDARY FLOWS WITHIN TURBOMACHINERY BLADINGS
Ph. Marchal and C. H. Sieverding *In* AGARD Secondary Flows in Turbomachines Sep. 1977 20 p refs (For availability see N78-11083 02-07)
Avail: NTIS HC A14/MF A01

Detailed experimental investigations of boundary layer development within blade passages were made. Research was done because of the complexity of secondary flows in turbomachinery bladings and the difficulty to describe these in a theoretical sound formulation. Contributions in the field of secondary flows in compressor cascades were recalled and results of the experiments carried out presently on turbine cascades were presented. Secondary flow developments under the influence of a variation of inlet boundary layer thickness and blade loading were described. Attention was devoted to the role of the leading edge vortex. Experimental techniques used included three-directional pressure probes, oil flow visualizations and smoke visualizations combined with the light sheet technique using illumination by laser. Author

N78-11095 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
INFLUENCE OF SECONDARY FLOW EFFECTS ON BLADE SURFACE PRESSURE MEASUREMENTS IN 2-D TRANSONIC TURBINE CASCADES
Hans-J. Heinemann *In* AGARD Secondary Flows in Turbomachines Sep. 1977 14 p refs (For availability see N78-11083

02-07)
Avail: NTIS HC A14/MF A01

A turbine cascade with high deflection was considered. Surface pressure measurements were carried out in different planes of the blade height, which was twice as great as usual. The blade was moveable through the end-walls. Measurements in different planes were possible with the same tappings and the ratio of blade height to blade length was slightly larger than two. Tests were performed in a plane cascade tunnel for subsonic, transonic and supersonic Mach number. The inlet angle and the pitch/chord ratio was varied and flow was visualized by oil flow pictures of the blade surface taken during wind tunnel runs. This method was also used for motion pictures in which flow behavior on the blade surface was observed for a high-turning rotor cascade and a stator cascade. Author

N78-11096 Durham Univ. (England). Dept. of Engineering Science.
SECONDARY FLOW IN CASCADES
D. Glynn, A. Spurr, and H. Marsh *In* AGARD Secondary Flows in Turbomachines Sep. 1977 12 p refs (For availability see N78-11083 02-07)
Avail: NTIS HC A14/MF A01

Recent work on secondary flow in linear cascades is described. The use of a power law profile for the end wall boundary layer was shown to lead to a discontinuity in the slope of the variation of exit angle across the span of the blades. The change in the shape of the wall boundary layer across a cascade was estimated and the corresponding change in axial velocity was included in the secondary flow theory. An iterative scheme was proposed where the distributed secondary vorticity is based on the predicted outlet angle rather than the mainstream flow angle. The pitch averaged streamwise vorticity was calculated at exit from the cascade and was shown to be in close agreement with experimental results. Author

N78-11097 Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
UNDERSTANDING TURBINE SECONDARY FLOW
Wayne A. Tall *In* AGARD Secondary Flows in Turbomachines Sep. 1977 12 p refs (For availability see N78-11083 02-07)
Avail: NTIS HC A14/MF A01

Careful control of flow in three dimensions, particularly in low aspect ratio, axial turbines, was considered in practical utilization of high temperature technology. A review of the literature of radial fluid motion and three-dimensional viscous flow in such cascades was done and many contradictory interpretations were disclosed which did not lead to improved understanding of low aspect ratio cascade flow. More recent experiments demonstrated that earlier experiments were guided by a false understanding of such flows, especially near the cascade endwalls. A recent effort using annular cascades and a three- dimensional, viscous flow analysis to improve stage performance rather than merely to correlate cascade results, demonstrated the tremendous potential of three-dimensional viscous flow analysis techniques to help in the understanding of this flow problem. Author

N78-11098* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF ENDWALL COOLING ON SECONDARY FLOWS IN TURBINE STATOR VANES
Louis J. Goldman and Kerry L. McLallin *In* AGARD Secondary Flows in Turbomachines Sep. 1977 29 p refs (For availability see N78-11083 02-07)
Avail: NTIS HC A14/MF A01 CSCL 21E

An experimental investigation was performed to determine the effect of endwall cooling on the secondary flow behavior and the aerodynamic performance of a coreturbine stator vane. The investigation was conducted in a cold-air, full-annular cascade, where three-dimensional effects could be obtained. Two endwall cooling configurations were tested. In the first configuration, the cooling holes were oriented so that the coolant was injected in line with the inviscid streamline direction. In the second configuration, the coolant was injected at an angle of 15 deg to the inviscid streamline direction and oriented toward the vane pressure surface. In both cases the stator vanes were solid and uncooled so that the effect of endwall cooling could be obtained directly. Total-pressure surveys were taken downstream of the stator vanes over a range of cooling flows at the design, mean-radius, critical velocity ratio of 0.778. Changes in the total-pressure contours downstream of the vanes were used to obtain the effect of endwall cooling on the secondary flows in the stator. Comparisons were made between the two cooled-endwall configurations and with the results obtained previously for solid endwalls. Author

N78-11099 Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.
A NUMERICAL TIME-DEPENDENT APPROACH FOR DESCRIBING COMPRESSIBLE INVISCID NON-ISENTROPIC ROTATIONAL FLOWS IN CURVED DUCTS
G. Bussi and M. Pandolfi *In* AGARD Secondary Flows in Turbomachines Sep. 1977 4 p refs (For availability see N78-11083 02-07)
Avail: NTIS HC A14/MF A01

A time-dependent technique of numerical analysis was used to describe transient and steady flow patterns. Complete Euler equations for 3D unsteady flow were integrated in time according to a two-level scheme of integration. A crucial point in this problem was represented by the computation at the boundaries. The philosophy consisted of matching local quasi-steady conditions representing the boundary and compatibility equations along characteristic lines. Details on the algorithms at solid walls, and at the inlet and the outlet of the duct are given. Author

N78-11100 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Luftstrahlantriebe.
SECONDARY FLOW STUDIES IN HIGH-SPEED CENTRIFUGAL COMPRESSOR IMPELLERS
D. Eckardt and H. Krain *In* AGARD Secondary Flows in Turbomachines Sep. 1977 13 p refs (For availability see N78-11083 02-07)
Avail: NTIS HC A14/MF A01

The flow fields within radial discharge and backward leaning implellers, running at tip speeds up to 400 m/s, were investigated by means of new laser techniques. Results, concerning the through-flow pattern of a radial bladed impeller, are presented. Detailed information about the superimposed secondary flow pattern was derived from flow angle measurements. On the basis of these studies an impression of the complex secondary vortex distribution in radial compressor impellers was gained. Finally, a comparison between measured and calculated streamwise vorticity near the exit of a radial discharge impeller is presented. Author

N78-11101 Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Turbomachinery.
SOME OBSERVATIONS FROM LOW-SPEED CASCADE TESTS CONCERNING SIDE WALL BOUNDARY LAYER SUCTION
B. A. Gustafson *In* AGARD Secondary Flows in Turbomachines Sep. 1977 10 p ref (For availability see N78-11083 02-07)
Avail: NTIS HC A14/MF A01

The influence of distributed porosity on cascade test results was investigated. Various side wall configurations were used. Flow pattern on the blade surfaces was visualized using ink traces on paper which covered the blades. Strong deviation from parallel flow was observed on the suction surface at high axial-velocity-density values. At lower values, the streamlines straightened out. It was found that the flow velocity has a component towards the wall partly as an effect of the side wall through-flow and partly as an effect of secondary flow due to boundary layer cross flow. B.L.P.

N78-11102 Stuttgart Univ. (West Germany). Inst. fuer Raumfahrtantriebe.
THREE-DIMENSIONAL FLOW IN HIGHLY LOADED ANNULAR CASCADES WITH ZERO SECONDARY VORTICITY
Hans-Heiner Fruehauf *In* AGARD Secondary Flows in Turbomachines Sep. 1977 6 p refs (For availability see N78-11083 02-07)
Avail: NTIS HC A14/MF A01

Significant three-dimensional effects occurring in inviscid high Mach number irrotational stator flows and absolute rotor flows

were considered. The magnitude of these effects was determined quantitatively. Limitations of simplified flow models in predicting these flows were discussed. Author

N78-11103 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Luftstrahlantriebe.

CORNER BOUNDARY LAYER AND SECONDARY FLOW WITHIN A STRAIGHT COMPRESSOR CASCADE

Juergen H. Renken *In* AGARD Secondary Flows in Turbomachines Sep. 1977 16 p refs (For availability see N78-11083 02-07)

Avail: NTIS HC A14/MF A01

Measurements at Mach number M [0.3 and Reynolds numbers Re] 300,000 in a straight compressor cascade with 48 deg cambered double circular arc profiles and contractable sidewalls are presented and compared with two and three-dimensional calculations. From the differences between measurement and calculation and from the evaluation of numerous corner layer publications conclusions were drawn towards secondary flow effects. Author

N78-11104 Birmingham Univ. (England). Dept. of Mechanical Engineering.

NOTE ON RELATIVE VORTICITY

J. W. Railly *In* AGARD Secondary Flows in Turbomachines Sep. 1977 2 p refs (For availability see N78-11083 02-07)

Avail: NTIS HC A14/MF A01

The presence of secondary flows in rotor passages was examined in flow relative to a rotor which has zero absolute vorticity at entry. Axial flow machines were considered for simplicity and the blades were regarded as being replaced by filaments of bound vorticity which lie along surfaces having the shape of the blade camber surfaces. An analysis was made to determine the mean angular momentum distribution throughout a rotor by using the sectorial angle, rotor angular velocity, as well as hub and tip radii. Author

N78-11105# Avco Lycoming Div., Stratford, Conn.

IMPROVED RESISTANCE TO ENGINE BIRD INGESTION Final Report

Herbert B. Kaehler Mar. 1977 234 p refs

(Contract DOT-FA76WA-3806)

(AD-A044203; FAA-RD-77-55) Avail: NTIS HC A11/MF A01 CSCL 21/5

An analytical design method capable of quantitatively evaluating and ranking rotor blades for resistance to bird impact damage was investigated. This method was used to design blades having sufficient tolerance to meet the bird-ingestion requirements of FAR 33.77 for turbofan engines in the 6800 to 1600 lbf thrust class. The design procedure was also used for the preliminary design of a damage-resistant boron/aluminum composite fan blade for the 6800 lbf thrust class engine. In addition, two protective devices designed to prevent an ingested bird from striking sensitive engine parts were presented. Author

N78-11106*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ALTITUDE TEST OF SEVERAL AFTERBURNER CONFIGURATIONS ON A TURBOFAN ENGINE WITH A HYDROGEN HEATER TO SIMULATE AN ELEVATED TURBINE DISCHARGE TEMPERATURE

Roy L. Johnsen and Richard R. Cullom Nov. 1977 57 p refs (NASA-TP-1068; E-9207) Avail: NTIS HC A04/MF A01 CSCL 21E

A performance test of several experimental afterburner configurations was conducted with a mixed-flow turbofan engine in an altitude facility. The simulated flight conditions were for Mach 1.4 at two altitudes, 12,190 and 14,630 meters. Turbine discharge temperatures of 889 and 1056 K were used. A production afterburner was tested for comparison. The research afterburners included partial forced mixers with V-gutter flameholders, a carbureted V-gutter flameholder, and a triple ring V-gutter flameholder with four swirl-can fuel mixers. Fuel injection variations were included. Performance data shown include augmented thrust ratio, thrust specific fuel consumption, combustion efficiency, and total pressure drop across the afterburner. Author

N78-11107# Rocket Research Corp., Redmond, Wash.

HYDRAZINE-FUELED AIRCRAFT STARTER FEASIBILITY DEMONSTRATION Final Report, 30 May 1975 - 31 Mar. 1977

W. E. Jorgenson and B. Schmitz Wright-Patterson AFB, Ohio AFAPL Mar. 1977 150 p

(Contract F33615-75-C-2027)

(AD-A042463; AFAPL-TR-77-16) Avail: NTIS HC A07/MF A01 CSCL 21/2

The purpose of this program was to determine the feasibility of converting an aircraft jet engine starter that is normally powered with an 8LBm solid propellant cartridge (type MXU4A/A), to an equivalent liquid monopropellant-fueled device utilizing state-of-the-art hydrazine technology, the single most difficult development constraint being that the complete hydrazine system must package within the space normally occupied by the MXU4A/A solid propellant cartridge in the starter breech. The feasibility of packaging a hydrazine fueled cartridge in the existing solid propellant breech volume and meeting performance requirements was successfully demonstrated using a breadboard hydrazine system in conjunction with actual cartridge starter hardware. GRA

N78-11108# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.

DSTR/501-M62B DYNAMIC INTERFACE CRITICAL SPEED PROBLEM Final Report, Oct. 1976 - Feb. 1977

W. H. Parker May 1977 46 p

(Contract DAAJ02-76-C-0072; DA Proj. 1F2-62209-AH-76)

(AD-A042441; DDA-EDR-9127; USAAMRDL-TR-77-12) Avail: NTIS HC A03/MF A01 CSCL 01/3

A dynamic interface problem was encountered during the Dynamic System Test Rig (DSTR) portion of the Heavy Lift Helicopter (HLH) program. This problem involved the dynamic incompatibility of the originai designs of the Detroit Diesel Allison (DDA) 501-M62B engine and the Boeing Vertol (BV) DSTR shafting. Presented is a detailed discussion of the interface problem and the steps taken toward solution. Design modifications to both the engine and shafting were necessary to synthesize an acceptable drive train configuration. Recommendations are proposed for avoidance of engine/airframe interface problems in future programs. Author (GRA)

N78-11109# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

ANALYTICAL AND EXPERIMENTAL STUDY OF SUBSONIC STALLED FLUTTER Final Report, 1 Apr. 1975 - 31 May 1977

R. A. Arnoldi, F. O. Carta, R. H. Ni, W. N. Dalton, and A. O. StAilaire 31 Jul. 1977 61 p refs

(Contract F44620-75-C-0066)

(AD-A043127; AFOSR-77-0854TR) Avail: NTIS HC A04/MF A01 CSCL 21/5

Experimental and analytical studies were conducted to determine a stall flutter prediction system. The initial phase of work was reported in AFOSR-TR-76-0829 (AD-A027 869): a second study phase, with an extended range of parameters, is documented in this report AFOSR-TR-77-0854. A series of experimental measurements of airfoil pressure distributions were made in an eleven-airfoil oscillating cascade wind tunnel. The air foils were oscillated in pitch about mid-chord pivots with an amplitude of + or - 2 deg at a tunnel velocity of 200 feet-per-second, obtaining reduced frequencies in the range of 0.03 to 0.20. The incident air angle was set at 8 deg, the cascade angle was 35 deg from a fully-closed setting; tests were run at interblade phase angles of zero, + or - 5 deg + or -10 deg + or -20 deg + or -30 deg + or -45 deg and + or - 60 deg. Sample time histories of pressure and hot film response are discussed in relation to previous OSR/SQUID data, and converted to unsteady pressure, lift and pitching moment coefficients. These data are compared with calculated values obtained from a computational program originated by P V Perumal for unsteady incompressible cascade flow with steady separation. An algorithm was fitted to the experimental coefficients, and used to predict the aerodynamic damping for a case of torsional stall flutter observed in the stator of an existing fan. In this calculation, the algorithm was modified by a compressibility correction obtained as the ratio of a cascade calculation for the

desired Mach number to a similar calculation for the Mach number of the algorithmic coefficients, both for unseparated flow. GRA

N78-11110# ARO, Inc., Arnold Air Force Station, Tenn.
INFRARED RADIATION FROM THE EXHAUST JET OF A J85-GE-5 TURBOJET Final Report
W. T. Bertrand AEDC Aug. 1977 15 p ref
(AF Proj. 3048)
(AD-A043282; ARO-ETF-TR-77-39; AEDC-TR-77-70) Avail: NTIS HC A02/MF A01 CSCL 17/5

Spectral measurements were made to compare infrared radiation from the exhaust jet of an engine burning JP-4 and fuel blends which simulate fuels derived from oil shale. A circular variable filter spectroradiometer was used to obtain spectral radiation data from the exhaust of a J85-GE-5 turbojet engine. Xylene was added to JP-4 to simulate the aromatic content of oil shale fuels. Radiation data were obtained at each of seven instrument locations with the engine operating at four power levels. Author (GRA)

N78-11111# Kentucky Univ., Lexington. Dept. of Engineering Mechanics.
THERMO-MECHANICAL STRESS ANALYSIS OF ADVANCED TURBINE BLADE COOLING CONFIGURATION Interim Scientific Report, 1 May 1976 - 30 Jun. 1977
F. J. Rizzo and D. J. Shippy Jul. 1977 40 p refs
(Grant AF-AFOSR-2824-75; AF Proj. 2307)
(AD-A043118; UKY-TR104-77-EM15; AFOSR-77-0950TR)
Avail: NTIS HC A03/MF A01 CSCL 21/5

Program improvement features in a Boundary Integral Equation Analysis Capability for thermomechanical problems are described. A number of solved problems are presented along with a progress report on the research directed toward a thermomechanical stress analysis in the vicinity of a cooling hole in a film-cooled turbine blade. Author (GRA)

N78-11112# Detroit Diesel Allison, Indianapolis, Ind.
THE EFFECT OF SPLITTER VANE CIRCUMFERENTIAL LOCATION ON THE AERODYNAMIC PERFORMANCE OF A SUPERSONIC COMPRESSOR CASCADE Final Technical Report, 1 Mar. 1976 - 1 Feb. 1977
Ronald E. Riffel and Sanford Fleeter Wright-Patterson AFB, Ohio AFAPL Feb. 1977 686 p refs
(Contract F33615-76-C-2052; AF Proj. 2307)
(AD-A043860; AFAPL-TR-77-20; FTR-9169) Avail: NTIS MF A01 CSCL 21/5

This report describes the experimental investigation of a linear stationary supersonic compressor cascade incorporating splitter vanes, blades of constant spanwise geometry, and contoured sidewalls. Previous experimental studies of this cascade showed that the cascade performance concurred with the modeled rotor data and that the splitter vane location and/or shape was not optimal. Hence, the overall objective of this program was to experimentally determine if a preferred circumferential position for the splitter vane existed. This was accomplished by modifying the original cascade hardware to permit the splitter vanes to be moved in the equivalent circumferential direction with respect to the principal blades. The aerodynamic characteristics of the cascade were then experimentally determined at 41 test conditions. These covered a range of static pressure ratios between 1.6 and the spill point at the design inlet Mach number, for each of eight splitter vane locations, one of which was the original 50 percent spacing location. Author (GRA)

N78-11113# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
APPLICATION OF FRACTURE MECHANICS AT ELEVATED TEMPERATURES Final Report
Raymond M. Wallace, Charles G. Annis, Jr., and David L. Sims Wright-Patterson AFB, Ohio AFML Apr. 1977 66 p refs
(Contract F33615-75-C-5097)
(AD-A044239; FR-8100; AFML-TR-76-176-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 21/5

The applicability of linear elastic fracture mechanics to predict crack growth at elevated temperatures is investigated. The interactive effects of stress, temperature, time, and environment on the crack growth of an advanced gas turbine disk alloy, IN-100, are described with an interpolative empirical model based on the hyperbolic sine. Author (GRA)

N78-11983# European Space Agency, Paris (France).
AMPLIFICATION OF DISTORTIONS IN AN AXIAL COMPRESSOR STAGE
Lionel Ravet *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-3 (ESA-TT-356) Nov. 1976 p 133-140 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-3, May - Jun. 1976 p 183-185 Original report in FRENCH previously announced as A76-41130 (For availability see N78-11977 02-99)
Avail: NTIS HC A09/MF A01

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N78-11114*# National Aeronautics and Space Administration, Washington, D. C.
CONCEPTS FOR THE DESIGN OF A COMPLETELY ACTIVE HELICOPTER ISOLATION SYSTEM USING OUTPUT VECTOR FEEDBACK
G. Schulz Oct. 1977 68 p refs Transl. into ENGLISH of "Konzepte zur Auslegung eines Vollaktiven Hubschrauber-Schwingungs Isolations Systems mittels Ausgangsvektorrueckfuehrung", Rept. DLR-DB-552-76/12 DFVLR, Oberpfaffenhofen, West Germ., Sep. 1976 63 p Original language document was announced as N77-21085 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75161; DLR-DB-552-76/12) Avail: NTIS HC A04/MF A01 CSCL 01C

The theory of output vector feedback (a few measured quantities) is used to derive completely active oscillation isolation functions for helicopters. These feedback controller concepts are tested with various versions of the BO 105 helicopter and their performance is demonstrated. A compensation of the vibrational excitations from the rotor and harmonics of the number of blades are considered. There is also a fast and automatic trim function for maneuvers. Author

N78-11115# Air Force Flight Test Center, Edwards AFB, Calif.
STABILITY AND CONTROL FLIGHT TEST THEORY, VOLUME 1 Final Report
Feb. 1977 390 p refs Revised 2 Vol.
(AD-A042583; AFFTC-TIH-77-1-Vol-1-Rev) Avail: NTIS HC A11/MF A01 CSCL 01/3

This handbook has been compiled by the instructors of the USAF Test Pilot School for use in the Stability and Control portion of the School's course. Most of the material in Volume I of this handbook has been extracted from several reference books and is oriented towards the test pilot. The flight test techniques and data reduction methods in Volume II have been developed at the Air Force Flight Test Center, Edwards Air Force Base, California. Author (GRA)

N78-11116# Boeing Commercial Airplane Co., Seattle, Wash.
AIRCRAFT ALERTING SYSTEMS CRITERIA STUDY. VOLUME 2: HUMAN FACTORS GUIDELINES FOR AIRCRAFT ALERTING SYSTEMS Final Report, Jan. - Nov. 1976
G. P. Boucek, Jr., J. E. Veitengruber, and W. D. Smith May 1977 140 p refs
(Contract DOT-FA73WA-3233)
(AD-A043383; D6-44200-Vol-2; FAA-RD-76-222-2) Avail: NTIS HC A07/MF A01 CSCL 01/4

Human factors literature that describes pilot response characteristics when confronted with aircraft warning, caution, and advisory signals was reviewed. The review covered visual, aural (sounds and voice), tactile, and bimodal alerts. Data obtained therefrom were categorized into: (1) non-aircraft-related test results, (2) aircraft-related test results, and (3) military standards/

design guidelines so as to establish the applicability of the data and to identify technical areas in which more human factors data relevant to aircraft-alerting systems may be required. Summaries of the literature for: (1) factors that affect signal detection, and (2) factors that affect time from detection to response are provided. The results of the review were used to establish preliminary design guidelines for alerting systems in future commercial transport aircraft. Author (GRA)

N78-11117# Dynamic Controls, Inc., Dayton, Ohio.
THE EVALUATION OF A DIGITAL HARDWARE VOTER/MONITOR IN AN AIRCRAFT CONTROL SYSTEM Final Report, Jan. 1975 - Jan. 1977
Harry W. Schreadley Wright-Patterson AFB, Ohio AFFDL May 1977 170 p refs
(Contract F33615-75-C-3068; AF Proj. 2049)
(AD-A043979; AFFDL-TR-77-30) Avail: NTIS HC A08/MF A01 CSCL 01/4

This report describes an evaluation and presents the test results of a Digital Hardware Voter/Monitor used as an input signal selector and fault detector when used in conjunction with an electro-hydraulic control system. The DHVM operated as intended by design although asynchronous operation caused the failure detection to be frequency dependent. A digital filter could be incorporated to reduce the frequency dependency of the failure detection circuitry. Author (GRA)

N78-11118# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Experimentelle Aerodynamik.
AN INVESTIGATION ON THRUST VECTOR CONTROL [EINE UNTERSUCHUNG ZUR STEUERUNG DES SCHUBVEKTORS]
A. Zacharias Oct. 1976 32 p refs In GERMAN
(DLR-IB-151-76/15) Avail: NTIS HC A03/MF A01

Work on pneumatic thrust vector control to increase the lift and maneuverability of an aircraft is presented. By sequential generation of reduced pressure zones near the jet exit plane of a propulsion gondola model, the thrust jet was deflected. Results of the tests show that pneumatic thrust vector control is in principle possible. ESA

N78-11974# European Space Agency, Paris (France).
WIND TUNNEL STUDY OF AN ACTIVE FLUTTER SUPPRESSION SYSTEM
Roger Destuynder *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-4 (ESA-TT-396) Jul. 1977 p 117-134 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-4, Jul.-Aug. 1976 p 233-241 Original report in FRENCH previously announced as A77-11159 (For availability see N78-11970 02-88)
Avail: NTIS HC A08/MF A01

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N78-11119*# National Aeronautics and Space Administration, Washington, D. C.
FLIGHT SIMULATORS. PART 1: PRESENT SITUATION AND TRENDS. PART 2: IMPLICATIONS FOR TRAINING
D. Hass and W. Volk Aug. 1977 39 p Transl. into ENGLISH from Flugsimulatoren. Teil 1: Stand und Entwicklungstendenzen. Teil 2: Auswirdung auf die Ausbildung, Deut. Gesellschaft Fuer Ortung und Nationale Tagung Ueber Simulation im Dienste des Verkehrs, Bremen (W. Germany), 15-17 Apr. 1975, paper 3.4 p 34 Original Language Document was announced as A75-44115 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75156) Avail: NTIS HC A03/MF A01 CSCL 14B

The present situation and developments in the technology of flight simulators based on digital computers are evaluated from the standpoint of training airline flight crews. Areas covered are minicomputers and their advantages in terms of cost, space and time savings, software data packets, motion simulation, visual simulation and instructor aids. The division of training time between aircraft and simulator training and the possible advantages from increased use of simulators are evaluated. Author

N78-11120# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.
FIELD COMPACTION OF BITUMINOUS MIXES FOR AIRPORT PAVEMENTS Final Report
Aston L. McLaughlin Apr. 1977 64 p refs
(AD-A041335/1; FAA-RD-77-42) Avail: NTIS HC A04/MF A01 CSCL 01/5

The mix design and construction factors directly affecting pavement compactibility are discussed. The rationale for the Federal Aviation Administration requirement concerning the compaction of bituminous airport pavements (98 percent minimum of Marshall density) is given and justified on the basis of expected pavement strength and durability. If certain design, construction and testing procedures are not within strict limits, difficulty or failure to achieve adequate compaction will result. Recommendations are made that will assure and facilitate the attainment of high quality pavements. Author

N78-11121*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CALIBRATION AND TEST CAPABILITIES OF THE LANGLEY 7- BY 10- FOOT HIGH SPEED TUNNEL
Charles H. Fox, Jr. and Jarrett K. Huffman May 1977 75 p
(NASA-TM-X-74027) Avail: NTIS HC A04/MF A01 CSCL 14B

The results of a new subsonic calibration of the Langley 7 by 10 foot high speed tunnel with the test section in a solid wall configuration are presented. A description of the test capabilities of the 7 by 10 foot high speed tunnel is also given. Author

N78-11122# Connecticut International Corp., Windsor Locks. SEPCO Div.
DEVELOPMENT OF A FRANGIBLE APPROACH LIGHT Final Report, Mar. 1975 - Mar. 1977
James N. Usko Mar. 1977 38 p
(Contract DOT-FA75WA-3610)
(AD-A043859; FAA-RD-77-71; Rept-7681) Avail: NTIS HC A03/MF A01 CSCL 17/7

An effort expended to develop a lightweight, frangible approach light housing is described. The goal of frangibility was not achievable as initially conceived, however, significant progress was made in the state of the art relative to housings which are lightweight, suitable for the visual aid purpose intended, and with a substantial measure of frangibility. Author

N78-11123# Naval Air Test Facility, Lakehurst, N.J. Launching Div.
DEADLOAD CALIBRATION PROGRAM OF CVN 68 CATAPULT CONFIGURATION Final Report, 28 Aug. 1972 - 17 Nov. 1976
Edward J. Yesunas 9 Mar. 1977 38 p refs
(AD-A042225; NATF-EN-1137) Avail: NTIS HC A03/MF A01 CSCL 01/5

This report describes a deadload calibration program conducted at the Naval Air Test Facility with the TC13 Mod 1 catapult in the final CVN 68 configuration. During the program, the standard CVN 68 catapult configuration was tested and then various catapult control parameters were varied during tests in order to clarify the operational limits of the CVN 68 catapult configuration. Tests were conducted with deadloads weighing from 10,500 to 84,500 pounds. Author (GRA)

N78-11124# Naval Civil Engineering Lab., Port Hueneme, Calif.
POROUS FRICTION SURFACE RUNWAY AT USNAS DALLAS, TEXAS Final Report, Sep. - Jun. 1976
R. B. Brownie Jun. 1977 34 p refs
(AD-A042181; CEL-TN-1487) Avail: NTIS HC A03/MF A01

CSCL 01/5

The performance of the porous friction surfacing (PFS) on a runway at the U.S. Naval Air Station, Dallas, Texas, was evaluated. Runway friction measurements with a mu-meter, field permeability measurements, visual condition surveys, corings of the pavement for determination of asphalt binder properties, and an investigation of aircraft accidents attributed to hydroplaning were accomplished. The results of these investigations show that the porous friction surface is providing (1) a highly skid-resistant surface for high-speed jet aircraft operations; (2) an excellent surface with few visible defects; and (3) a minimum service life of 5 years with a potentially much longer life. Author (GRA)

N78-11125# Naval Training Equipment Center, Orlando, Fla.
THEORETICAL ANALYSIS OF THE PROPOSED PANORAMIC MOVING TARGET SCREEN SIMULATOR Interim Report, Oct. 1975 - Jan. 1976
Robert Entwistle, Neil Mohon, and Frank Oharek May 1977 38 p refs
(AD-A043181; NAVTRAEQUIPC-IH-285) Avail: NTIS HC A03/MF A01 CSCL 05/9

An analysis is given of a proposed weapon fire simulator which effectively represents the Integrated Parapet Foxhole concept of defense. The training requirements and gaming configurations are outlined. The resolution of the projected display and perspective anomalies place constraints on the simulator configuration. Methods of simulating the weapon fire are proposed. Techniques for scoring are analyzed along with the probability of simultaneous and identical hits. Requirements for sound are mentioned. Requirements for recording multiple target locations are derived. The Panoramic Motion Target Screen System appears feasible. There are no technological areas that will require an excessive amount of research. Author (GRA)

N78-11126# Naval Postgraduate School, Monterey, Calif.
DESIGN, CONSTRUCTION AND TESTING OF A SUB-SCALE TURBOJET TEST CELL M.S. Thesis
Holden Willets Hewlett Mar. 1977 74 p refs
(AD-A043005) Avail: NTIS HC A04/MF A01 CSCL 21/5

A one-eighth scale turbojet test cell was designed and constructed and initially operated to determine facility characteristics. Experiments were then conducted to determine engine operating characteristics, inlet velocity profiles and cell pressure profiles for two augmentor-to-engine spacings. Experimental data were compared to existing computer model predictions and showed qualitative agreement. Recommendations are made for facility improvements. Author (GRA)

N78-11127# Human Resources Research Organization, Alexandria, Va.
SOME CURRENT PROBLEMS IN SIMULATOR DESIGN, TESTING AND USE
Paul W. Caro Mar. 1977 15 p refs Presented at the 38th Military Operations Res. Symp., Fort Eustis, Va., 7-9 Dec. 1976 Prepared in cooperation with Seville Research Corp., Pensacola, Fla.
(Contract F44620-76-C-0118; AF Proj. 2313)
(AD-A043240; HumRRO-PP-2-77; AFOSR-77-0990TR) Avail: NTIS HC A02/MF A01 CSCL 14/2

This report is concerned with the general problem of the effectiveness of simulator training and reflects information developed during the conduct of aircraft simulator training research projects sponsored by the Air Force, Army, Navy, and Cost Guard. Problems are identified related to simulator design, testing and use that impact simulator training effectiveness. These problems are: (1) isolation of the simulator user from the design and development process, (2) inattention to behavioral and training models during that process, (3) ignoring training considerations during simulator testing, (4) inadequate feedback to simulator designers concerning simulator training effectiveness, (5) inattention to techniques of simulator training that differ from techniques of aircraft training, (6) inadequate training for simulator instructors, (7) use of rate of simulator utilization as an index of its training effectiveness, and (8) inadequacies of simulator training cost effectiveness data. Author (GRA)

N78-11128# Human Resources Research Organization, Alexandria, Va.
SOME FACTORS INFLUENCING AIR FORCE SIMULATOR TRAINING EFFECTIVENESS Interim Report
Paul W. Caro Mar. 1977 106 p refs Prepared in cooperation with Seville Research Corp., Pensacola, Fla.
(Contract F44620-76-C-0118; AF Proj. 2313)
(AD-A043239; HumRRO-TR-77-2; AFOSR-77-0971TR) Avail: NTIS HC A06/MF A01 CSCL 14/2

A study of U.S. Air Force simulator training was conducted to identify factors that influence the effectiveness of such training and to learn how its effectiveness is being determined. The research consisted of a survey of ten representative Air Force simulator training programs and a review of the simulator training research literature. A number of suspected or potential factors influencing simulator training effectiveness were identified. These factors include simulator design for training, visual display fidelity, platform motion system fidelity handling characteristics, training program features, trainee and instructor characteristics, and attitudes and expectations toward simulator training. The discussion of each factor reviews relevant literature and Air Force simulator design features and training practices. Ten simulator training effectiveness study design models were identified. Efforts by the Air Force to validate the simulator training activities surveyed are described in relation to these ten models. It was found that the programs surveyed had not been subjected to formal evaluation studies that would establish their training effectiveness in quantitative terms. Therefore, the influence of factors identified during the survey upon such training could only be hypothesized. Recommendations were made concerning research and administrative action that could enhance future simulator training effectiveness. Author (GRA)

N78-11129# Air Force Human Resources Lab., Brooks AFB, Tex. Flying Training Div.
EFFECTS OF SIMULATOR TRAINING AND PLATFORM MOTION ON AIR-TO-SURFACE WEAPONS DELIVERY TRAINING Final Report, Aug. 1976 - Mar. 1977
Thomas H. Gray and Robert R. Fuller Jul. 1977 50 p refs
(AD-A043649; AFHRL-TR-77-29) Avail: NTIS HC A03/MF A01 CSCL 05/9

The objectives of this research were to determine: (a) the extent to which generalized, conventional, air-to-surface (A/S) weapons delivery training in the Advanced Simulator for Pilot Training (ASPT) transferred to a specific aircraft; (b) the contribution of six-degree-of-freedom platform motion to the transfer of training from simulator to aircraft; and (c) the differential effects, if any, of this simulator training on student pilots of differing ability levels. Twenty-four students progressed through lead-in training, receiving all training except the A/S flights, and were then assigned into matched experimental and control groups. All of the subjects received academic training in weapons delivery techniques and procedural training on F-5B operations. At this point, the students in the control groups flew two data collection sorties in the F-5B aircraft, performing 10, 15, and 30 deg. bomb deliveries. The experimental groups received A/S weapons delivery training in ASPT on 10, 15, and 30 deg bomb deliveries with a fixed number of trials on each event. The experimental subjects then received two data collection flights in the F-5B identical to those received by the control group. Analysis of the results proved that simulator training significantly increased air-to-surface weapons delivery skills (e.g., approximately double the number of qualifying bombs, a one-fourth reduction in circular error) but that platform motion was not a contributing factor in this process. It was also found that novice student pilots of greater initial ability benefit most from such simulator training when a minimum fixed number of trials is used. GRA

N78-11130# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Experimentelle Aerodynamik.
DESCRIPTION OF THE NEW REGULATING VALVE FOR THE TRANSONIC SUPERSONIC WIND TUNNEL [BESCHREIBUNG DES NEUEN REGELVENTILS FUER DEN TRANS-UEBERSCHALLWINDKANAL]
G. Kausche and W. Puffert Nov. 1976 42 p refs In GERMAN
(DLR-IB-151-76/6) Avail: NTIS HC A03/MF A01

Reliability tests of the automatic regulating valve of the transonic/supersonic wind tunnel of the Institute for Aerodynamics

are described. The required constancy of the prechamber pressure during a test with a sufficiently high storage pressure could be achieved. At prechamber pressures above 2 bar the values guaranteed after 2 sec during pressure increase were not reached, but the values guaranteed after 4 sec were achieved. Tests of an additional high pressure safety device for transonic operation are also described. ESA

N78-11975# European Space Agency, Paris (France).
PERFORMANCE AND FLOW QUALITY OF THE CERT T2 INJECTOR DRIVEN TUNNEL
Andre Mignosi and Claude Quemard *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-4 (ESA-TT-396) Jul. 1977 p 135-140 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-4, Jul.-Aug. 1976 p 243-245 Original report in FRENCH previously announced as A77-11160 (For availability see N78-11970 02-88)
Avail: NTIS HC A08/MF A01

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N78-11131*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PUBLICATIONS OF THE JET PROPULSION LABORATORY 1976
15 Jul. 1977 177 p
(Contract NAS7-100)
(NASA-CR-155226; JPL-Bibl-39-18) Avail: NTIS HC A09/MF A01 CSCL 05B

The formalized technical reporting, released January through December 1975, that resulted from scientific and engineering work performed, or managed, by the Jet Propulsion Laboratory is described and indexed. The following classes of publications are included: (1) technical reports; (2) technical memorandums; (3) articles from bi-monthly Deep Space Network (DSN) progress report; (4) special publications; and (5) articles published in the open literature. The publications are indexed by: (1) author, (2) subject, and (3) publication type and number. A descriptive entry appears under the name of each author of each publication; an abstract is included with the entry for the primary (first-listed) author. Unless designated otherwise, all publications listed are unclassified. Author

N78-11132*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, Jul. - Aug. 1977
15 Oct. 1977 237 p refs
(Contract NAS7-100)
(NASA-CR-155225; JPL-PR-42-41) Avail: NTIS HC A11/MF A01 CSCL 22A

The facilities, programming system, and monitor and control system for the deep space network are described. Ongoing planetary and interplanetary flight projects are reviewed, along with tracking and ground-based navigation, communications, and network and facility engineering. For individual titles, see N78-11133 through N78-11156.

N78-11133*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Office of Tracking and Data Acquisition.
NETWORK FUNCTIONS AND FACILITIES **c14**
N. A. Renzetti *In its* The Deep Space Network 15 Oct. 1977 p 1-3 (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

The objectives, functions, and organization of the deep space network are summarized; deep space station, ground communication, and network operations control capabilities are described. Author

N78-11134*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. TDA Engineering Section.
THE DSN PROGRAMMING SYSTEM **c61**
W. D. Hodgson *In its* The Deep Space Network 15 Oct. 1977 p 4-9 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

The programming system provides the DSN with implementation tools and practices for producing DSN software. The system, as well as its key characteristics, status plans, and expected benefits, are described. Author

N78-11135*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. TDA Engineering Office.
DSN MONITOR AND CONTROL SYSTEM, MARK 3-77 **c14**
W. G. Stinnett *In its* The Deep Space Network 15 Oct. 1977 p 10-15 (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

The DSN monitor and control system, Mark 3-77 configuration is discussed; the implementation is noted that explains the evolution from the Mark 3-75 to the Mark 3-77 configuration. Author

N78-11136*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Deep Space Network Operations Section.
VIKING EXTENDED MISSION SUPPORT **c14**
D. W. H. Johnston *In its* The Deep Space Network 15 Oct. 1977 p 16-32 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 22A

The initial two weeks of post-MDS Viking related testing at DSS 14 are examined. Some of the periodic tests routinely carried out with the Viking Orbiter spacecraft by the spacecraft telecom and DSN teams to ensure optimum performance or detect any degradation in the spacecraft radio or command equipment are also addressed. Author

N78-11137*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Deep Space Network Operations.
PIONEER MISSION SUPPORT **c14**
T. P. Adamski *In its* The Deep Space Network 15 Oct. 1977 p 33-38 ref (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

Activities within the deep space network in support of the Pioneer Project's in-flight spacecraft during the period April through July 1977 are reported. The amount of tracking coverage provided by the network and operational testing of the Mark 3 data subsystems at DSS 14 are summarized. Author

N78-11138*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT **c14**
P. S. Goodwin and G. M. Rockwell *In its* The Deep Space Network 15 Oct. 1977 p 39-42 ref (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

Activities of the network operations organization in support of the Helios Project from 15 June through 15 August 1977 are reported. Author

N78-11139*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
NEAR SUN RANGING **c32**
A. I. Zygielbaum *In its* The Deep Space Network 15 Oct. 1977 p 43-50 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

Near superior solar conjunction, radio waves traveling between earth and a spacecraft graze the sun. Ranging, or determining the roundtrip radio signal propagation time, provides measurements of signal delay induced by the solar corona and gravity field. Techniques are described which enhance range data quality during the harsh signal conditions existing at solar conjunction. Author

N78-11140*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
FEASIBILITY STUDY OF FAR-FIELD METHODS FOR CALIBRATING GROUND STATION DELAYS: AN INTERIM REPORT **c14**
T. Sato *In its* The Deep Space Network 15 Oct. 1977 p 51-56 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

Results of a survey and arrive-at-cost/performance estimates of various methods of implementing far field calibrations of ground station delays are presented. Both direct and indirect methods for far field calibrations are also discussed. Author

N78-11141*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Tracking Systems and Applications Section.

A TECHNIQUE TO DETERMINE UPLINK RANGE CALIBRATION DUE TO CHARGED PARTICLES **c32**

S. C. Wu and F. B. Winn *In its* The Deep Space Network 15 Oct. 1977 p 57-81 refs (For availability see N78-11132 02-12)

Avail: NTIS HC A11/MF A01 CSCL 17B

A technique is presented to determine uplink range change due to line-of-sight charged particles using downlink S/X range and Doppler and 2-way DRVID data. The line-of-sight relative charged particle distribution is first estimated from these data by a point matching method. The uplink range change is then synthesized by the weighted sum of the delayed downlink range changes. Simulation analysis shows 2 to 6 cm agreement agreement between the true and the synthesized uplink range changes. Demonstration using Viking 1975 radio metric data shows 4 to 22 cm consistency between the uplink range calibration solutions synthesized from S-Drivid and X-DRVID. The consistency is an order of magnitude superior to that equating uplink and downlink effects. Author

N78-11142*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.

DOPPLER PROFILES OF RADIO FREQUENCY INTERFERENCE **c32**

B. K. Levitt *In its* The Deep Space Network 15 Oct. 1977 p 82-85 refs (For availability see N78-11132 02-12)

Avail: NTIS HC A11/MF A01 CSCL 17B

The DSN is currently developing a wideband, digital system for monitoring the RF environment at each receive complex. One of the characteristics that will be used to identify observed RFI (radio frequency interference) sources is the time variations of their received spectra. As a preliminary aid to this effort, Doppler profiles were computed for earth satellites and planes with typical flight parameters. The analysis shows that Doppler rates will be high enough to cause spectral smearing and degrade the surveillance station detection capability under certain conditions. Author

N78-11143*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.

SAMPLED-DATA SYSTEM ANALYSIS OF ANTENNA CONICAL-SCAN TRACKING **c17**

R. A. Winkelstein *In its* The Deep Space Network 15 Oct. 1977 p 86-100 refs (For availability see N78-11132 02-12)

Avail: NTIS HC A11/MF A01 CSCL 17B

Tracking mode equations for both spacecraft signals and radio source signals are developed. In the case of spacecraft tracking, a rationale is presented for selection of parameters which minimizes the sum of the required scan radius and three times the RMS error jitter. With this criterion, resonable system performance can be obtained with signals down to receiver threshold. For radio source tracking, the RMS error jitter is negligible, and a set of system parameters is recommended which allows conservative operation of the system. Author

N78-11144*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.

ANTENNA POINTING SUBSYSTEM DRIVE TAPE GENERATOR: ANOTHER NEW INTERFACE **c61**

R. F. Emerson *In its* The Deep Space Network 15 Oct. 1977 p 101-102 (For availability see N78-11132 02-12)

Avail: NTIS HC A11/MF A01 CSCL 09B

To continue service to radio science targets, a new interface between the ephemerides of these targets and the APS program was required. The program, called APSTAPE, written for this purpose is described. An important feature of the program is that it performs a read-after-punch operation, which ensures that the drive tapes generated will be error free. The program was successfully used in the field. Author

N78-11145*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Data Systems Section.

AN MBASIC USER PROFILE **c61**

R. L. Schwartz *In its* The Deep Space Network 15 Oct. 1977 p 103-111 refs (For availability see N78-11132 02-12)

Avail: NTIS HC A11/MF A01 CSCL 09B

The preliminary results of an empirical study of MBASIC user programs are presented. The study is part of an ongoing effort, seeking to discover the features and capabilities of the MBASIC processor which are being utilized. Author

N78-11146*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Data Systems Section.

CRISPFLOW, A STRUCTURED PROGRAM DESIGN FLOWCHART **c61**

R. C. Tausworthe and K. C. Landon *In its* The Deep Space Network 15 Oct. 1977 p 112-126 refs (For availability see N78-11132 02-12)

Avail: NTIS HC A11/MF A01 CSCL 09B

A description is given of the design, prototype implementation, and use of an automated tool, called CRISPFLOW, for generating design flowcharts of structured programs. The user of this tool provides a file of English-like textual statements which directs the drawing of the flowcharts. Layout, symbol sizing, location of text, scaling, and other routine tasks are performed automatically. Author

N78-11147*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. TDA Engineering Office.

THE CTA 21 RADIO SCIENCE SUBSYSTEM: NON REAL-TIME BANDWITH REDUCTION OF WIDEBAND RADIO SCIENCE DATA **c32**

A. L. Berman and J. I. Molinder *In its* The Deep Space Network 15 Oct. 1977 p 127-134 ref (For availability see N78-11132 02-12)

Avail: NTIS HC A11/MF A01 CSCL 17B

The concept of a centralized facility at Jet Propulsion Lab (JPL) to reduce the bandwidth of wideband digital recordings originated with the Pioneer Venus Differential Long Baseline Interferometry Experiment. A functional description is presented of the resulting facility - the CTA 21 Radio Science Subsystem (CRS), located within JPL at the Compatibility Test Area (CTA-21). Particularly emphasized is a mathematical derivation and description of the digital filter process which comprises the core of the CRS. Author

N78-11148*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. TDA Engineering Office.

ELECTRON DENSITY IN THE EXTENDED CORONA: TWO VIEWS **c46**

A. L. Berman *In its* The Deep Space Network 15 Oct. 1977 p 135-145 refs (For availability see N78-11132 02-12)

Avail: NTIS HC A11/MF A01 CSCL 04A

Recent analyses of Viking and Mariner solar conjunction radio metric data led to two significantly different views of the average radial dependence of electron density in the extended corona. The two models are compared and it is concluded that the steeper model: (1) is in excellent agreement with other experimental observations of coronal electron density, (2) is consistent with the predicted and observed radial dependence of the solar wind velocity, and (3) augments the case for a turbulence scale that expands linearly with radial distance, when considered in combination with recent observations of the radial dependence of RMS phase fluctuations. Author

N78-11149*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.

S-/X-BAND MICROWAVE OPTICS DESIGN AND ANALYSIS FOR DSN 34-METER DIAMETER ANTENNA **c33**

D. L. Nixon and D. A. Bathker *In its* The Deep Space Network 15 Oct. 1977 p 146-165 refs (For availability see N78-11132 02-12)

Avail: NTIS HC A11/MF A01 CSCL 09C

A discussion is given of the feed system configuration, RF optics design and predicted gain and noise temperature performance of the DSN 26 meter antenna S-/X-Band upgrade project. A previously developed and demonstrated dual band feed system employing separately located feeds, combined in a reflex-dichroic reflector arrangement, has been adapted to a particularly compact overall design. Special design techniques to minimize aperture blockage and then evaluate resultant performance are discussed in detail. Final predicted antenna gain and noise temperature performance values are given. Author

N78-11150*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Data Systems Section.
CONFIGURATION CONTROL AND AUDIT ASSEMBLY c82
A. P. Irvine *In its* The Deep Space Network 15 Oct. 1977 p 166-171 (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 05B

The Configuration Control and Audit Assembly Project is responsible for the implementation of a computer-based system for acquiring, managing and distributing a subset of the Deep Space Network Data Base of operational and management information. Author

N78-11151*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystem Section.
MICROCOMPUTER CENTRAL PROCESSING UNIT MODULE c61
O. B. Parham *In its* The Deep Space Network 15 Oct. 1977 p 172-175 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

A new multipurpose microcomputer central processing unit (CPU) module is described and illustrated. The module is designed to stand alone and also be upwardly expandable. Author

N78-11152*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. TDA Engineering Office.
FAST ALGORITHMS FOR COMPUTING MERSENNE-PRIME NUMBER-THEORETIC TRANSFORMS c61
I. S. Reed (Southern Calif. Univ.) and T. K. Truong *In its* The Deep Space Network 15 Oct. 1977 p 176-205 refs (For availability see N78-11132 02-12)
(Grant AF-AFOSR-2798-75)
Avail: NTIS HC A11/MF A01 CSCL 09B

It shown that Winograd's algorithm can be used to compute an integer transform over GF(q), where q is a Mersenne prime. This new algorithm requires fewer multiplications than the conventional fast Fourier transform (FFT). This transform over GF(q) can be implemented readily on a digital computer. This fact makes it possible to more easily encode and decode BCH and RS codes. Author

N78-11153*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Data Systems Section.
GCF CENTRAL PERFORMANCE MONITOR: FUNCTIONAL DESCRIPTION c60
N. C. S. Lau *In its* The Deep Space Network 15 Oct. 1977 p 206-208 (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

A description is given of the Ground Communications Facilities (GCF) Central Performance Monitor (CPM) which gathers information on the operational status of the Central High Speed and Wideband Assemblies. This monitor information is formatted and forwarded to the Central Communication Monitor Processor. The CCM Processor, in turn, provides near real time displays and printouts of the status information and any resulting alarm indications. The ability of the GCF to quickly detect and correct circuit failures will be enhanced by the addition of the CPM. Author

N78-11154*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Engineering Section.
A THERMODYNAMIC ANALYSIS OF A SOLAR-POWERED JET REFRIGERATION SYSTEM c44
F. L. Lansing and V. W. Chai *In its* The Deep Space Network 15 Oct. 1977 p 209-217 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 10A

A method of using solar energy to drive a jet refrigeration system is described and analyzed. A new technique is presented in the form of a performance nomogram combining the energy and momentum equations to determine the performance characteristics. A numerical example, using water as the working fluid, is given to illustrate the nomogram procedure. The resulting coefficient of performance was found comparable with other refrigeration systems such as the solar-absorption system or the solar-Rankine turbocompressor system. Author

N78-11155*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Engineering Section.
ESTIMATED DISPLACEMENTS FOR THE VLBI REFERENCE POINT OF THE DSS 14 ANTENNA c14
H. McGinness *In its* The Deep Space Network 15 Oct. 1977 p 218-225 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

The maximum displacement of the defined VLBI reference point is shown to be primarily a function of the ambient air temperature. Author

N78-11156*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. TDA Planning Office.
DYNAMIC MODELING AND SENSITIVITY ANALYSIS OF SOLAR THERMAL ENERGY CONVERSION SYSTEMS c44
C. L. Hamilton *In its* The Deep Space Network 15 Oct. 1977 p 226-232 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 10A

Dynamic modeling is used to begin identifying what must be known about input radiation and system dynamic characteristics to estimate performance reliably. Daily operation of two conceptual solar energy systems was simulated under varying operating strategies with time-dependent radiation intensity ranging from smooth input of several magnitudes to input of constant total energy whose intensity oscillated with periods from 1/4 hour to 6 hours. Integrated daily system output and efficiency were functions of both level and dynamic characteristics of isolation. Sensitivity of output to changes in total input was greater than one. These findings support the feeling that interplay of radiation dynamics and collector response times affects the quality of energy delivered, and therefore system performance. Author

N78-11157*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
LIFE SCIENCE PAYLOADS PLANNING STUDY Final Report
W. G. Nelson and G. W. Wells Oct. 1977 55 p refs
(Contract NAS9-14589)
(NASA-CR-151550; MDC-G7234) Avail: NTIS HC A04/MF A01 CSCL 22A

Preferred approaches and procedures were defined for integrating the space shuttle life sciences payload from experiment solicitation through final data dissemination at mission completion. The payloads operations plan was refined and expended to include current information. The NASA-JSC facility accommodations were assessed, and modifications recommended to improve payload processing capability. Standard format worksheets were developed to permit rapid location of experiment requirements and a Spacelab mission handbook was developed to assist potential life sciences investigators at academic, industrial, health research, and NASA centers. Practical, cost effective methods were determined for accommodating various categories of live specimens during all mission phases. A.R.H.

N78-11158*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
ASTP SCIENCE DEMONSTRATION DATA ANALYSIS Final Report
Philomena G. Grodzka and Sidney V. Bourgeois Oct. 1977 45 p refs
(Contract NAS8-32222)
(NASA-CR-150466; LMSC-HREC-TR-D497499) Avail: NTIS HC A03/MF A01 CSCL 22A

Analyses of the Apollo-Soyuz science demonstrations on chemical foams and liquid spreading are presented. The chemical foams demonstation showed that aqueous foams and gas/liquid dispersions are more stable in low-g than on the ground. Unique chemical reactions in low-g foams and gas/liquid dispersions are therefore possible. Further ground tests on the formaldehyde clock reaction led to the rather surprising conclusions that surfaces can exert a nucleation effect and that long-range surface influences on chemical reaction rates are apparently operative. Author

N78-11159# Swedish Board for Space Activities, Solna.
SPACE ACTIVITY IN SWEDEN, 1976
1977 35 p refs Presented at the 20th COSPAR Plenary Meeting and Assoc. Activities, Tel Aviv, 13-18 Jun. 1977
Avail: NTIS HC A03/MF A01

Following an outline of the national organization for space activities and a review of international cooperative venture, national scientific space programs in sounding rockets, space physics, and atmospheric physics are summarized together with space applications programs. ESA

N78-11160# Deutsche Forschungsgemeinschaft, Bad Godesberg (West Germany).
SPACE RESEARCH IN THE FEDERAL REPUBLIC OF GERMANY, 1976
1977 62 p refs
Avail: NTIS HC A04/MF A01

Following a list of groups active in space research, some space experiments are described. Summaries are given of activities in the fields of aeronomy; ionospheric physics; magnetosphere; solar radiation and solar wind; and solar system. International cooperation programs are given as well as balloon, laboratory, ground truth and theoretical work. ESA

N78-11161# Finnish National Committee of COSPAR, Otaniem.
SPACE ACTIVITIES IN FINLAND, 1976
1977 6 p refs
Avail: NTIS HC A02/MF A01

Space applications programs such as remote sensing of earth resources, meteorology and communications are summarized together with space research programs in the field of the ionosphere and magnetosphere and satellite geodesy. ESA

N78-11162# Royal Society, London (England).
UNITED KINGDOM REPORT ON SPACE RESEARCH, 1976-1977
1977 123 p refs Presented at the 20th COSPAR Plenary Meeting and Assoc. Activities, Tel Aviv, 7-18 Jun. 1977
Avail: NTIS HC A06/MF A01

Research involving experiments flown on balloons, aircraft, rockets, and satellites, as well as ground-based observations of such vehicles, undertaken by scientists since January 1976, is summarized. Projects include: Ariel 5, X-ray satellite launched Oct. 15, 1974, for which data from the Leicester University survey instrument are available in the form of a source catalog; Skylark 12 rocket launched from Andoya, simultaneously with a smaller Fulmar, for the study of the aurora; preparation of Ariel 6, devoted to cosmic ray and X-ray studies, expected launch in 1978; collaboration with NASA and ESA in the construction of the International Ultraviolet Explorer satellite and with the Netherlands and NASA in the infrared satellite project. ESA

N78-11163# Comision Nacional de Investigacion del Espacio, Madrid.
[SPACE RESEARCH IN SPAIN]
1977 33 p Presented at the 20th COSPAR Plenary Meeting and Assoc. Activities, Tel Aviv, 7-18 Jun. 1977 Original contains color illustrations
Avail: NTIS HC A03/MF A01

The following space research activities, coordinated and sponsored by the National Committee for Space Investigation, are reviewed: INTASAT program; multimodal mass spectrometer; impedance probes; meteorological research; sounding rocket launchings at El Arenosillo station; technology program; and Madrid ground space station. ESA

N78-11164# Centre National d'Etudes Spatiales, Paris (France).
[RESEARCH ACTIVITIES OF THE NATIONAL SPACE RESEARCH CENTER] Annual Report, 1 Jul. 1975 - 30 Jun. 1976 [RAPPORT D'ACTIVITE 1975/76]
30 Jun. 1976 112 p refs In FRENCH
Avail: NTIS HC A06/MF A01

Various sections deal with European, bilateral, and national space programs; available means and methods; personnel resources; financial resources; and management structure. ESA

N78-11165# Kongelige Danske Videnskabernes Selskab, Copenhagen (Denmark).
SPACE RESEARCH IN DENMARK
1977 13 p refs Presented at the 20th COSPAR Plenary Meeting and Assoc. Activities, Tel Aviv, 13-18 Jun. 1977
Avail: NTIS HC A02/MF A01

Space research at the Danish Space Research Institute in the field of cosmic rays, as well as that of plasma and space physics, is presented. Research projects at the Meteorological Institute were directed towards the study of the high latitude ionosphere and magnetosphere carrying out rocket and ground based measurements. ESA

N78-11166# Eurospace, Paris (France).
EUROPEAN ACTIVITIES IN SPACE TECHNOLOGY 1975-1976
ESA Sep. 1977 194 p refs Sponsored by ESA
(ESA-SP-1003) Avail: NTIS HC A09/MF A01

An inventory is presented drawn up on the basis of questionnaires mailed in the summer of 1976 and returned towards the end of that year and in early 1977. Hardware developments at component and subsystem level for spacecraft, launchers, and ground installations are covered. Software development is excluded, as are routine test activities. A list of companies, institutions, and organisations is included, together with a subject index. ESA

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N78-11167# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
POSITIONING OF GEOSTATIONARY SATELLITES AS AN EXAMPLE OF THE MINIMIZATION OF NON-DIFFERENTIABLE FUNCTIONS WITH RESTRICTIONS [POSITIONIERUNG GEOSTATIONAERER SATELLITEN ALS BEISPIEL ZUR MINIMIERUNG NICHTDIFFERENZIERBARER FUNKTIONEN UNTER RESTRIKTIONEN]
Dieter Kraft, Christian Kredler (Tech. Univ., Munich), and K. H. Well 26 Apr. 1977 114 p refs In GERMAN
(DLR-IB-552-77/8) Avail: NTIS HC A06/MF A01

A numerical method for solving the problem of the minimization of nondifferentiable functions, a problem occurring with the positioning of geostationary satellites, is presented. Test examples of the positioning of OTS are presented. The results of two other examples show that the proposed approximation in connection with penalty procedures produces useful results. A description of the computer program and listings of the DETOP (deterministic optimization) and FUNMIN protocols are annexed. ESA

N78-11168# Analytical and Computational Mathematics, Zurich (Switzerland).
UNIFIED SYSTEM FOR ORBIT COMPUTATION (USOC). VOLUME 2: ORBITS IN THE SOLAR SYSTEM
W. Maag and S. Starke Jun. 1977 47 p refs
(Contract ESOC-2805/76-D-JS)
(ESA-CR(P)-970) Avail: NTIS HC A03/MF A01

The Unified System for Orbit Computation (USOC), see N77-17120, was extended to allow an arbitrary planet or the sun to be the central body of a spacecraft's orbit. Single step integration and the multirevolution orbit prediction method were made available to the system. The Kustaanheimo-Stiefel uniformly regular elements and the Poincare-similar elements were made available for numerical integration. Orbit generation and auxiliary calculations can be run separately. The preprocessor was updated and split into subroutines. The new options were implemented by adding new versions of library modules representing existing kinds of functional modules to the subroutine library. The implemented standard options allow the solution of initial value problems for planets and the sun as central body. Applying the features of phasing and iteration by cycling makes the system extendable to interplanetary boundary value problem capabilities. Author (ESA)

N78-11169# Royal Aircraft Establishment, Farnborough (England).
CONTINUOUS WHOLE-EARTH COVERAGE BY CIRCULAR-ORBIT SATELLITE PATTERNS

J. G. Walker Mar. 1977 78 p refs
(RAE-TR-77044; BR57655) Avail: NTIS HC A05/MF A01

Earlier studies of continuous whole-earth coverage by patterns of satellites in equal-period circular orbits were extended by means of a computer program to patterns of up to 25 satellites and to the provision of up to seven-fold continuous coverage. The program is described and various factors which may influence the choice of pattern for a particular application are discussed, including the level of coverage provided, the minimum satellite separation, and the number and form of the earth-tracks traced by a pattern at a particular orbital altitude. A method is given of selecting a short-list of potentially suitable patterns, prior to detailed study. Author (ESA)

N78-11982# European Space Agency, Paris (France).
A NEW METHOD OF CALCULATING SATELLITE EPHEMERIDES FOR LASER TRACKING SYSTEMS
Michel Staron and Didier Vasseur *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-3 (ESA-TT-356) Nov. 1976 p 101-132 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-3, May - Jun. 1976 p 171-182
Original report in FRENCH previously announced as A76-41129 (For availability see N78-11977 02-99)
Avail: NTIS HC A07/MF A01

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N78-11170*# Evans and Sutherland Computer Corp., Salt Lake City, Utah.
IMPROVED SCENE GENERATOR CAPABILITY Final Report
28 Oct. 1977 27 p Original contains color illustrations
(Contract NAS9-14010)
(NASA-CR-151547) Avail: NTIS HC A03/MF A01 CSCL 14B

Components of an integrated system having all functions for model preparation and generation, image computation and scene generation, and collision detection and reporting for the visual simulation of space shuttle maneuvers and its interaction with the manipular arm and other objects, as well as during earth landing exercises are described. High surface solution by range priority allows for correct views of dynamically moving objects from any viewpoint. Smooth shading, anti-aliasing and edge smoothing techniques provide a high quality picture. The collision detection system allows for simulation of impenetrable objects and docking maneuvers, and the modeling systems permit production of new data bases for desired simulations. Author

N78-11133*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Office of Tracking and Data Acquisition.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Oct. 1977 p 1-3 (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

N78-11135*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. TDA Engineering Office
DSN MONITOR AND CONTROL SYSTEM, MARK 3-77
W. G. Stinnett *In its* The Deep Space Network 15 Oct. 1977 p 10-15 (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

N78-11136*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Deep Space Network Operations Section.
VIKING EXTENDED MISSION SUPPORT
D. W. H. Johnston *In its* The Deep Space Network 15 Oct. 1977 p 16-32 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 22A

N78-11137*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Deep Space Network Operations.
PIONEER MISSION SUPPORT
T. P. Adamski *In its* The Deep Space Network 15 Oct. 1977 p 33-38 ref (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

N78-11138*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT
P. S. Goodwin and G. M. Rockwell *In its* The Deep Space Network 15 Oct. 1977 p 39-42 ref (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

N78-11140*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
FEASIBILITY STUDY OF FAR-FIELD METHODS FOR CALIBRATING GROUND STATION DELAYS: AN INTERIM REPORT
T. Sato *In its* The Deep Space Network 15 Oct. 1977 p 51-56 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

N78-11155*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Engineering Section.
ESTIMATED DISPLACEMENTS FOR THE VLBI REFERENCE POINT OF THE DSS 14 ANTENNA
H. McGinness *In its* The Deep Space Network 15 Oct. 1977 p 218-225 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N78-11171*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC EXPERIMENTS IN THE FLIGHT OF THE 1977 BIOLOGICAL SATELLITE (DRAFT PLAN)
Aug. 1977 46 p Transl. into ENGLISH from "Nauchnyye Eksperim. v Polete Biol. Sputnika 1977 g (Plan-Prospekt)", Moscow, Acad. of Sci. of the USSR, 1977 p 1-49 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75032) Avail: NTIS HC A03/MF A01 CSCL 22A

The physiological, biological, radiobiological and radiophysical experiments planned for the 1977 biological satellite are described. The biological experiments will involve rats, higher and lower plants, insects and other biological specimens carried on the biosatellite. The responses of these organisms to weightlessness, artificial gravity, cosmic radiation particles and general flight factors will be studied. The radiophysical experiments will investigate certain properties of cosmic radiation as well as the possibility of creating electrostatic and dielectric radiation shields under actual space-flight conditions. Author

N78-11172*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A FULLY REUSABLE, HORIZONTAL TAKEOFF SPACE TRANSPORT CONCEPT WITH TWO SMALL TURBOJET BOOSTERS
L. Robert Jackson, James A. Martin, and William J. Small Oct. 1977 50 p refs
(NASA-TM-74087) Avail: NTIS HC A03/MF A01 CSCL 22A

Results of a preliminary study of a space transport concept are presented. The concept consists of a winged orbiter containing ascent propellants and two small turbojet-powered winged boosters, used for acceleration to supersonic speeds. The concept offers full reuse and horizontal takeoff from numerous existing airports. With current structure and rocket technology, this transport concept has lower gross weight for a selected payload than single-stage-to-orbit concepts, which require structural advancements. Discussion includes alternatives to the baseline

space transport concept which improve performance; such as advanced structures, dual-fuel rockets, and lightweight scramjets for the orbiter. A concept of using a stretched shuttle orbiter instead of an all-new configuration is discussed for two payload-class vehicles. Author

N78-11173# Committee on Science and Technology (U. S. House).
SEASAT: COST, PERFORMANCE AND SCHEDULE REVIEW
Washington GPO 1977 275 p refs Hearings before Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 95th Congr., 1st Sess., No. 17, 21 Jul., 10 and 15 Aug. 1977 (GPO-96-206) Avail: Subcomm. on Space Sci. and Applications

Testimony given during oversight hearings to identify problems and examine changes in the scope of NASA's SEASAT program is presented. Topics discussed include program goals and benefits, technology plan, plan management and key features for a possible civil operational system, capabilities for acquiring and processing ocean measurements and maritime meteorological data, the economic and social benefits of user agency products, and the resource impact on activity costs and block-funded requirements. A.R.H.

N78-11174*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN EVALUATION OF COMPOSITE PROPULSION FOR SINGLE-STAGE-TO-ORBIT VEHICLES DESIGNED FOR HORIZONTAL TAKE-OFF
James A. Martin Nov. 1977 31 p refs
(NASA-TM-X-3554; L-11548) Avail: NTIS HC A03/MF A01 CSCL 22B

Composite propulsion was analyzed for single-stage-to-orbit vehicles designed for horizontal take-off. Trajectory, geometric, and mass analyses were performed to establish the orbital payload capability of six engines. The results indicated that none of the engines performed adequately to deliver payloads to orbit as analyzed. The single-stage turbine and oxidizer-rich gas generator resulted in a low engine specific impulse, and the performance increment of the ejector subsystem was less than that of a separate rocket system with a high combustion pressure. There was a benefit from incorporating a fan into the engine, and removal of the fan from the airstream during the ramjet mode increased the orbital payload capability. Author

N78-11175# European Space Agency, Paris (France).
SMOP-STRUCTURAL MASS OPTIMISATION PROGRAMME
Jul. 1977 47 p refs Proc. of Lectures held at ESTEC, Noorwijk, Neth., 9-10 Jun. 1977
(ESA-SP-133) Avail: NTIS HC A03/MF A01

The development of a minimum mass core structure configuration for a communication type satellite and the verification of the design was discussed in the context of the ESA Structural Mass Optimization Program (SMOP). Papers on dynamic analysis and testing of a mass optimized satellite structure and on the experimental verification of SMOP structure dynamic analyses by means of modal survey testing were given. For individual titles, see N78-11176 through N78-11177.

N78-11176# Contraves Corp., Zurich (Switzerland).
SMOP 2 - DYNAMIC ANALYSIS AND TESTING OF A MASS-OPTIMIZED SATELLITE STRUCTURE
P. A. Villalaz and U. Schibli *In* ESA SMOP - Struct. Mass Optimisation Programme Jul. 1977 p 1-19 refs (For availability see N78-11175 02-15)
Avail: NTIS HC A03/MF A01

A survey of the development, manufacturing, and testing activities which led to a strictly mass optimized satellite structure is provided. The Structural Mass Optimization Program (SMOP) was part of the Supporting Technology Program (STP) for the European Communications Satellite (ECS). The dynamic investigations performed on the primary satellite structure refurbished into a dynamic model within a follow-up program called SMOP are discussed. A modal survey test and a vibration test on the structure were carried out in order to investigate its dynamic performance characteristics and to confirm its dynamic behavior predicted by an eigenvalue and a frequency response analysis. Author (ESA)

N78-11177# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. for Aeroelasticity.
EXPERIMENTAL VERIFICATION OF SMOP - STRUCTURE DYNAMIC ANALYSES BY MEANS OF MODAL-SURVEY TESTING
M. Degener *In* ESA SMOP - Struct. Mass Optimisation Programme Jul. 1977 p 25-36 refs (For availability see N78-11175 02-15)
Avail: NTIS HC A03/MF A01

The rigid body modes and the elastic normal modes were measured; correlation of the results and the pertaining analytical results are discussed. On the basis of the modal survey test data a dynamic response analysis was performed, the results of which are compared with the shaker test. The influence of damping coupling and damping nonlinearity was studied. Author (ESA)

N78-11178# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A DYNAMIC SATELLITE SCHEDULING ALGORITHM
William J. Taylor 7 Jul. 1977 20 p
(Contract F19628-76-C-0002)
(AD-A043636; ETS-15; ESD-TR-77-176) Avail: NTIS HC A02/MF A01 CSCL 22/2

A computer program to dynamically schedule satellite observations has been installed and tested. The principle of the program is to apply weighting factors for each of several pertinent criteria to the angular distance between the current telescope position and the current predicted position of each satellite in a predefined list. Initial tests showed favorable results with few large displacements of the telescope. The program executes in 5-7 seconds of shared real time for a typical mix of about one hundred satellites. Author (GRA)

N78-11179# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
SHORT DESCRIPTION OF THE ORBIT PROGRAMS USED FOR SYMPHONIE A AND B [KURZBESCHREIBUNG DER BEI SYMPHONIE A UND B EINGESETZTEN BAHNPROGRAMME]
A. Leibold 10 Mar. 1976 14 p refs In GERMAN
(DLR-IB-552-76/1) Avail: NTIS HC A02/MF A01

The orbit programs with which Symphonie A and B were brought successfully into a geostationary orbit are described. The programs discussed briefly are apogee maneuver program comprising OPSTRA, STOCHOP, and APOGIMP; course orbit correction program comprising DETOP and APOGIMP; fine orbit correction program containing OWSYN, RINCL, and INKOR; position retention program: OWKOR, HSCHUB, RINCL, and INKOR; and orbit determination and prediction program: NONAME, ELKORR, SICDI, and EPHPLO. ESA

N78-11180# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
ORBIT MANEUVER OPTIMIZATION FOR AN ARABIAN COMMUNICATION SATELLITE (ARCOMSAT)
A. Leibold 1976 15 p Prepared jointly with MBB, Ottobrunn, West Ger.
(Contract BMFT-AN-4340-1-001)
(DLR-IB-552-76/15) Avail: NTIS HC A02/MF A01

The optimal scheduling and designing for the ARCOMSAT S/C orbital maneuvers in transfer orbit (TO) and drift orbit (DO) were investigated. The study was done for an SHF and for a VHF TM/TC/TR station concept. Because the relevant station visibility ranges of the two concepts differ not too much, the optimization results turn out to be the same for the SHF and VHF concept. Due to the fact that not all satellite subsystems are specified in detail, the submitted results are somewhat preliminary but can be considered as reasonable estimates for the injection procedure. ESA

N78-11181# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

SHORT COURSE ON GROUND OPERATIONS SYSTEMS FOR GEOSTATIONARY SATELLITES: INJECTION OF GEOSTATIONARY SATELLITE SYMPHONIE
A. Leibold Nov. 1976 77 p refs Prepared for Indian Space Res. Organ., Bangalore
(DLR-IB-552-76/21) Avail: NTIS HC A05/MF A01

The French-German Symphonie satellite ground operations are described in detail: orbit and attitude control system; launch vehicle, ascending trajectory and launch window; injection, positioning, and maneuver schedule; problems associated with perigee and apogee injection errors; outline of the mathematical problem; ground stations for Symphonie; apogee/station/maneuver schedule; optimization of injection procedure; total velocity increment for injection; interface orbit determination/correction; and injection of Symphonie A. ESA

N78-11182# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
SHORT COURSE ON GROUND OPERATIONS SYSTEMS FOR GEOSTATIONARY SATELLITES: ORBIT MANEUVER PROGRAMS (SYMPHONIE)
A. Leibold Oct. 1976 39 p refs Prepared for Indian Space Res. Organ., Bangalore
(DLR-IB-552-76/22) Avail: NTIS HC A03/MF A01

The orbit programs which have been used for injection and positioning and which are now used for stationkeeping of Symphonie satellites A and B are described briefly: apogee maneuver; orbit coarse corrections; orbit fine corrections; station keeping; mission analysis; and orbit determination. Selections from the Symphonie flight model 2 mission report on transfer and positioning phase are annexed. ESA

N78-11183# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
DETERMINATION OF THE MOST EFFICIENT UTILIZATION OF THE GEOSTATIONARY ORBIT FOR COMMUNICATION SATELLITES USING A SYSTEM MODEL BASED ON SHARED CHANNEL INTERFERENCE MEASUREMENTS WITH PSK MODULATED SIGNALS [UNTERSUCHUNGEN ZUR BESTMOEGLICHEN AUSNUTZUNG DER GEOSTATIONAEREN SATELLITENBAHN FUER NACHRICHTENSATELLITEN ANHAND EINES SYSTEMMODELLES AUF DER GRUNDLAGE VON GLEICHKANAL-STOERBEEINFLUSSUNGSMESSUNGEN MIT PSK-MODULIERTEN SIGNALEN]
T. Hentrich and G. Zorbach Apr. 1977 29 p refs In GERMAN Report will also be announced as translation (ESA-TT-427)
(FTZ-445-TBR-15) Avail: NTIS HC A03/MF A01

A systems model was used to determine the shared channel interference of a PSK (phase shift keying) modulated signal by up to four PSK modulated noise signals; the minimum distance at which a maximum allowable interference occurs was found for neighboring communication satellites, working in the same frequency range. The quantitative measure for interference used was the degradation Delta C/N (db) as a function of carrier-to-interferer ratio C/I (db) for certain bit error rates. Results show that the magnitude of occurring degradation is determined in essence by both direct neighbor satellites and that the degradation has a clear threshold value characteristic dependent on C/I or the corresponding angular decoupling lambda of the neighbor satellites. ESA

N78-11992# European Space Agency, Paris (France).
ON THE CONTENSOU SWITCHING THEORY
Nguyen X. Vinh *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-2 (ESA-TT-408) Sep. 1977 p 1-25 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-2, Mar. - Apr. 1977 p 67-74 Original report in FRENCH previously announced as A77-32944 (For availability see N78-11991 02-99)
Avail: NTIS HC A09/MF A01

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N78-11184*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
INDEPENDENT EVALUATION OF SHUTTLE FLIGHT CONTROL SYSTEM Final Report
R. Lee 14 Oct. 1977 16 p refs
(Contract NAS9-14915)
(NASA-CR-141581; TRW-28520-H001-R0-00) Avail: NTIS HC A02/MF A01 CSCL 22A

A brief summary of the work performed on the Approach and Landing Test (ALT) shuttle flight control system is presented. (FCS) and a bibliography of the formal reports are included which document the activities in detail. In general, the activities were grouped in four categories: (1) independent evaluation of ALT FCS software design; (2) independent evaluation of Software Development Laboratory (SDL) testing of ALT FCS software; (3) independent evaluation of Shuttle Avionics Integration Laboratory (SAIL) ALT FCS testing; and (4) independent evaluation of ALT flight test results. Author

N78-11185*# Chrysler Corp., Michoud, La. Space Div.
RESULTS OF AN INVESTIGATION OF THE ACOUSTIC AND VIBRATIONAL ENVIRONMENT OF A FULL SCALE SPACE SHUTTLE ORBITER STRUCTURAL TEST PANEL WITH SIMULATED TPS IN THE AMES UNITARY PLAN WIND TUNNEL, MODEL 81-0, TEST OS8A AND B
R. B. Kingsland (Rockwell Intern. Corp., Downey, Calif.) Oct. 1977 609 p refs
(Contract NAS9-13247)
(NASA-CR-151378; DMS-DR-2179) Avail: NTIS HC A99/MF A01 CSCL 22B

Results of tests OS8A and B and pertinent test and model information are presented. The test was conducted in two parts. Test OS8A was performed in the NASA/ARC unitary 11-foot section and OS8B was conducted in the NASA/ARC unitary 9 x 7 tunnel. Test objectives were to investigate thermal protection system (TPS) tile sensitivity to extreme pressure gradients and vibration and to define the TPS aerodynamic environment. The model utilized for OS8 was a full-scale representation of a portion of the space shuttle orbiter lower wing carry-through structure forward of the aft tank strut and propellant lines. Thermal protection tiles were simulated on the model. The model was instrumented with static pressure orifices, accelerometers, and dynamic pressure transducers (Kulites). A total rake was utilized to obtain boundary layer surveys. Author

N78-11186*# Martin Marietta Corp., Denver, Colo.
TECHNOLOGY REQUIREMENTS FOR ADVANCED EARTH-ORBITAL TRANSPORTATION SYSTEMS Final Report
Rudolph C. Haefeli, Ernest G. Littler, John B. Hurley, and Martin G. Winter Washington NASA Oct. 1977 211 p refs
(Contract NAS1-13916)
(NASA-CR-2866) Avail: NTIS HC A10/MF A01 CSCL 22A

Areas of advanced technology that are either critical or offer significant benefits to the development of future Earth-orbit transportation systems were identified. Technology assessment was based on the application of these technologies to fully reusable, single-stage-to-orbit (SSTO) vehicle concepts with horizontal landing capability. Study guidelines included mission requirements similar to space shuttle, an operational capability begining in 1995, and main propulsion to be advanced hydrogen-fueled rocket engines. Also evaluated was the technical and economic feasibility of this class of SSTO concepts and the comparative features of three operational take-off modes, which were vertical boost, horizontal sled launch, and horizontal take-off with subsequent inflight fueling. Projections of both normal and accelerated technology growth were made. Figures of merit were derived to provide relative rankings of technology areas. The influence of selected accelerated areas on vehicle design and program costs was analyzed by developing near-optimum point designs. Author

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N78-11187# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

TELEMETRY, TELECOMMAND AND TRACKING CONTACT TIMES FOR SEAP CIRCULAR ORBITS [TELEMETRIE/TELEKOMMANDO- UND TRACKING-KONTAKTZEITEN FUER SEAP-KREISBAHNEN]

E. F. Jochim and A. E. Pietrass 29 Jan. 1977 58 p refs In GERMAN

(DLR-IB-552-77/2) Avail: NTIS HC A04/MF A01

Telemetry/telecommand and tracking 24 hour contact times for SEAP (Spacelab Experiments Propulsion Platform) circular orbits between 200 and 1000 km and inclinations of 28.7, 55, and 90 deg are given. SEAP will bring a payload from Spacelab into a target orbit and return it afterwards possibly back to Spacelab or the shuttle orbiter. The return command guidance can be controlled from the ground networks of ESA or NASA or with the Tracking and Data Relay Satellite System (TDRSS). For these three networks the contact times mentioned are given. ESA

N78-11143*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.

SAMPLED-DATA SYSTEM ANALYSIS OF ANTENNA CONICAL-SCAN TRACKING

R. A. Winkelstein *In its* The Deep Space Network 15 Oct. 1977 p 86-100 refs (For availability see N78-11132 02-12) Avail: NTIS HC A11/MF A01 CSCL 17B

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N78-11188*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EXPERIMENTAL PERFORMANCE OF AN ABLATIVE MATERIAL AS AN EXTERNAL INSULATOR FOR A HYPERSONIC RESEARCH AIRCRAFT

Richard L. Puster and Andrew J. Chapman Nov. 1977 47 p refs

(NASA-TN-D-8490; L-11148) Avail: NTIS HC A03/MF A01 CSCL 11D

An ablative material composed of silica-filled elastomeric silicone was tested to evaluate its thermal and structural performance as an external insulator, or heat shield, for a hypersonic research aircraft. The material was also tested to determine whether it would form a durable char layer when initially heated and thereafter function primarily as an insulator with little further pyrolysis or char removal. Aerothermal tests were representative of nominal Mach 6 cruise conditions of the aircraft, and additional tests were representative of Mach 8 cruise and interference heating conditions. Radiant heating tests were used to simulate the complete nominal Mach 6 surface-temperature history. The silica char that formed during aerothermal tests was not durable. The char experienced a general and preferential surface recession, with the primary mechanism for char removal being erosion. Tests revealed that radiant heating is not a valid technique for simulating aerodynamic heating of the material. Author

N78-11189# Societe Crouzet, Valence (France).

SECA (ONBOARD ELECTRONIC ADAPTIVE CONTROL SYSTEM FOR TELEMETRY AND TELECOMMAND). VOLUME 1: TEXT Final Report [SECA. VOLUME 1: TEXTE]

Paris ESA 15 Mar. 1977 196 p In FRENCH 2 Vol.

(Contract ESTEC-2396/75-AK)

(Rept-26/2753-Vol-1; ESA-CR(P)-980-Vol-1) Avail: NTIS HC A09/MF A01

The study and realization of a breadboard model and a prototype SECA (digital electronic adaptive control system) are described together with its test unit. The SECA accomplishes the same tasks as a conventional analog control unit. It interfaces on one part with the external units and on the other with the telemetry and telecommand system. The system basically consists of four subsystems: a clock, an arithmetic and logic unit for data processing, a program and a working memory, and an input/output unit. Acceptance and qualification test results are also given. ESA

N78-11190# Societe Crouzet, Valence (France).

SECA (ONBOARD ELECTRONIC ADAPTION CONTROL SYSTEM FOR TELEMETRY AND TELECOMMAND). VOLUME 2: FIGURES Final Report [SECA. VOLUME 2: FIGURES]

Paris ESA 15 Mar. 1977 65 p In FRENCH 2 Vol.

(Rept-26/2753-Vol-2; ESA-CR(P)-980-Vol-2) Avail: NTIS HC A04/MF A01

Figures are presented related to the study and realization of a breadboard model and a prototype SECA (digital electronic adaptive control system), together with its test unit. ESA

N78-11191# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

DEVELOPMENT OF MODAL TECHNIQUES USING EXPERIMENTAL MODAL DATA. END OF PHASE 1

A. Bertram, M. Degener, and R. Freymann Paris ESA 31 Aug. 1977 72 p refs

(Contract ESTEC-2998/76-NL-PP(SC))

(DLR-IB-253-77-C-05; ESA-CR(P)-992) Avail: NTIS HC A04/MF A01

The development of modal survey techniques for spacecraft structures was investigated. Effects of small modifications of structural configuration were studied. Analytical calculations were carried out for a two-mass oscillator, and experimental studies are reported on a wing model with external stores. The direct modal correction method proved to be the most suitable modal technique because it can be applied most universally. The modal synthesis methods, developed in the last years, are related to the application of the finite element technique in general. They mainly differ in the use of different mode sets; therefore, which modes can be determined experimentally was investigated. The dynamic response analysis of coupled structural systems is described in a general manner, assuming an unchanged interface motion. For this case usual procedures can be applied, taking into account damping nonlinearities, if necessary. Further analytical and experimental investigations must show the validity of the assumption of an unchanged interface motion. ESA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N78-11192*# Hughes Research Labs., Malibu, Calif.
EXTENDED PERFORMANCE SOLAR ELECTRIC PROPULSION THRUST SYSTEM STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report, 14 Feb. - 29 Aug. 1977
R. L. Poeschel, E. I. Hawthorne, Y. C. Weisman, M. Frisman, G. C. Benson, R. J. McGrath, R. M. Martinelli, T. L. Linsenbardt, and J. R. Beattie Sep. 1977 110 p refs Prepared in cooperation with Hughes Space and Communications Group, Los Angeles (Contract NAS3-20395)
(NASA-CR-135281) Avail: NTIS HC A06/MF A01 CSCL 21C

Several ion-thrust system design concepts were evaluated and compared using the specifications of the most advanced 30-cm engineering model thruster as the technology base. Emphasis was placed on relatively high-power missions (60 to 100 kW) such as a Halley's comet rendezvous. The extensions in thruster performance required for the Halley's comet mission were defined and alternative thrust system concepts were designed in sufficient detail for comparing mass, efficiency, reliability, structure, and thermal characteristics. Confirmation testing and analysis of thruster and power-processing components were performed. A baseline design was selected from the alternatives considered, and the design analysis and documentation were refined. The baseline thrust system design features modular construction, 'conventional' power processing, and a 'concentrator' solar array concept and is designed to interface with the Space Shuttle. A program development plan was formulated that outlines the work structure considered necessary for developing the flight hardware for the baseline thrust system of a mission to rendezvous with Halley's comet during December 1985. Author

N78-11193# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
DETERMINATION OF LOSSES IN T-BURNER WITH CIRCUMFERENTIAL SLOTTED VENT Final Report, 1 Oct. 1976 - 1 Apr. 1977
S. N. B. Murthy and J. R. Osborn May 1977 52 p refs (Grant AF-AFOSR-3140-77; AF Proj. 2308)
(AD-A043100; AFOSR-77-0984TR) Avail: NTIS HC A04/MF A01 CSCL 21/8

This research program was concerned with an attempt to resolve the controversy surrounding the description of the vent of the T-burner. That controversy, whether there arises a gain or a loss of acoustic energy through the vent, is fundamental to an understanding of the evaluation of T-burner results. The research program was to have involved developing an improved analysis along with a small experimental program to verify that analysis. The program has been terminated. Author (GRA)

N78-11194# Societe Europeene de Propulsion, Vernon (France).
MAGE ORBITAL PROPULSION UNIT (MOPU) DEFINITION STUDY. VOLUME 1: TECHNICAL
Apr. 1977 540 p refs Partly in FRENCH and partly in ENGLISH Prepared jointly with MAN, Munich
(Contract ESTEC-2646/NL-PP(SC))
(ESA-CR(P)-946-Vol-1) Avail: NTIS HC A23/MF A01

Technical and financial aspects of the MAGE Orbital Propulsion Unit (MOPU) study are presented. The propulsion unit is dedicated to allow the Exosat satellite to be launched by Ariane, based on the MAGE III solid propellant motor. The Exosat satellite was originally planned to be launched in 1979 by means of a Thor-Delta 2914. The reprogramming of the project leads to a launch at the end of 1980 or the beginning of 1981. Since the first operational Ariane launch could be made in December 1980, the Exosat mission could be autonomously carried by ESA provided Exosat is designed to withstand the Ariane launching conditions. Topics dealt with include study context and objectives; performance and mission analysis; MOPU description; management plan; development and integration plan; product assurance plan and overall planning. Technical notes on mutation dampers, thermal behavior, and structural analysis are also included. ESA

N78-11195# Royal Aircraft Establishment, Farnborough (England).
A FAST RESPONSE THRUST TRANSDUCER FOR GAS-DYNAMIC THRUSTERS
B. C. Barber Feb. 1977 50 p refs
(RAE-TR-77025; BR58096) Avail: NTIS HC A03/MF A01

Problems associated with the measurement of the thrust and impulse of short pulses (20 to 100 ms) of low thrust (about 100 mN) electrothermal hydrazine thrustors are discussed. Thrust pulses measured by a conventional transducer are distorted by the self-excitation of mechanical and acoustic resonances present in the trustor and thrust transducer. A technique for mitigating the effects of these resonances is described. This technique involves transforming the electrical signal from the thrust transducer in real time by an analog network with a transfer function which is the inverse of the transfer function of the thrustor-thrust transducer system. Results are presented showing the transient thrust measurement of an electrothermal hydrazine thrustor. Author (ESA)

N78-11980# European Space Agency, Paris (France).
A NEW TECHNIQUE FOR THE FABRICATION OF CESIUM ION EMITTERS FOR ELECTROSTATIC THRUSTERS
Arvind Shroff, Andre Hivert, and Jean Labbe *In its* La Rech. Aerospatiale, Bi-monthly Bull. no. 1976-3 (ESA-TT-356) Nov. 1976 p 50-66 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-3, May - Jun. 1976 p 149-155 Original report in FRENCH previously announced as A76-41127
(For availability see N78-11977 02-99)
Avail: NTIS HC A07/MF A01

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N78-11196*# National Aeronautics and Space Administration, Washington, D. C.
EFFECTS OF Fe2O3 ADDITION ON THE NITRIDATION OF SILICON POWDER
Y. Hasegawa, Y. Inomata, K. Kijima, and T. Matsuyama Aug. 1977 16 p refs Transl. into ENGLISH from J. Ceram. Soc. Japan, v. 85(2), no. 978, 1977 p 83-90 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Natl. Inst. for Res. in Inorganic Mater., Honshu (Japan)
(Contract NASw-2790)
(NASA-TM-75129) Avail: NTIS HC A02/MF A01 CSCL 11D

The reaction of silicon powder and nitrogen was studied in the range of 1300-1400 C. When an addition of Fe2O3 was more than 0.8wt%, the reaction was linear and compared to samples with no Fe2O3, the reaction velocity increased 5 to 10 times. The reactions were mediated by the process of peeling and cracking in a thin layer of Si2N4 formed on the silicon particles or on the surface of the Fe-Si melts. As the addition of Fe2O3 increased, the reaction activation energy for highly pure samples decreased. Fe2O3 which exceeded the Si3N4 solubility limits was finally converted to d-Fe. Author

N78-11197*# Massachusetts Inst. of Tech., Cambridge.
ANALYSIS OF DELAMINATION IN UNIDIRECTIONAL AND CROSSPLIED FIBER COMPOSITES CONTAINING SURFACE CRACKS Interim Report

S. S. Wang and J. F. Mandell May 1977 35 p refs
(Grant NsG-3044)
(NASA-CR-135248) Avail: NTIS HC A03/MF A01 CSCL 11D

A two-dimensional hybrid stress finite element analysis is described which was used to study the local stress field around delamination cracks in composite materials. The analysis employs a crack tip singularity element which is embedded in a matrix interlayer between plies of the laminate. Results are given for a unidirectional graphite/epoxy laminate containing a delamination emanating from a surface crack through the outside ply. The results illustrate several aspects of delamination cracks: (1) the localization of the singular stress domain within the interlayer; (2) the local concentration of stress in the ply adjacent to the crack; (3) the nature of the transverse normal and interlaminar shear stress distributions; and (4) the relative magnitudes of K sub 1 and K sub 2 associated with the delamination. A simple example of the use of the analysis in predicting delamination crack growth is demonstrated for a glass/epoxy laminate. The comparisons with experimental data show good agreement.
Author

N78-11198*# National Aeronautics and Space Administration, Washington, D. C.
A REPORT OF A CONFERENCE ON ADVANCED COMPOSITES: AN ASSESSMENT OF THE FUTURE
Leonard A. Harris 1977 49 p Conf. held in Washington, D. C., 10-11 Jun. 1975
(NASA-TM-74979) Avail: NTIS HC A03/MF A01 CSCL 11D

A conference was held to evaluate the current status and future commitment to composites by government and industry. This reassessment, was felt needed because of an apparent transition in the acceptance of composites. The management of government agencies restated their progress and commitment to the development of composites and industrial management defined their concerns and requirements to commit to the future use of composites.
Author

N78-11199*# Boeing Commercial Airplane Co., Seattle, Wash.
THE 737 GRAPHITE COMPOSITE FLIGHT SPOILER FLIGHT SERVICE EVALUATION Annual Report, Apr. 1975 - Mar. 1976
Robert L. Stoecklin May 1976 33 p refs
(Contract NAS1-11668)
(NASA-CR-144984; AR-2) Avail: NTIS HC A03/MF A01 CSCL 11D

The flight-service experience of 110 graphite-epoxy spoilers on 737 transport aircraft and related ground-based environmental exposure of graphite-epoxy material specimens is reported. Spoilers were installed on each of 27 aircraft representing seven major airlines operating throughout the world. Based on visual, ultrasonic, and destructive testing, there is no evidence of moisture migration into the honeycomb core and no core corrosion. Tests of removed spoilers and of ground-based exposure specimens after the second year of service indicate modest changes in composite strength.
Author

N78-11200*# National Bureau of Standards, Boulder, Colo.
CRYOGENIC FOAM INSULATION: ABSTRACTED PUBLICATIONS
Frank R. Williamson NASA Sep. 1977 171 p refs Sponsored by NASA
(NASA-RP-1002) Avail: NTIS HC A08/MF A01 CSCL 11D

A group of documents were chosen and abstracted which contain information on the properties of foam materials and on the use of foams as thermal insulation at cryogenic temperatures. The properties include thermal properties, mechanical properties, and compatibility properties with oxygen and other cryogenic fluids. Uses of foams include applications as thermal insulation for spacecraft propellant tanks, and for liquefied natural gas storage tanks and pipelines.
Author

N78-11201# IIT Research Inst., Chicago, Ill.
DETERMINATION OF THE PRINCIPAL MECHANICAL PROPERTIES OF REINFORCED PLASTIC LAMINATES FOR AIRCRAFT Final Technical Report, Oct. 1973 - Apr. 1977
K. E. Hofer Apr. 1977 47 p refs
(Contract DAAA21-74-C-0114)
(AD-A043350) Avail: NTIS HC A03/MF A01 CSCL 11/9

The purpose of the test program described in this report was to develop engineering data on the mechanical and physical properties of reinforced plastic laminates for aircraft. Following are the systems tested: Modmor I Graphite/Narmco 5208; AS Graphite/Hercules 3501-5; T300 Graphite/Narmco 5208; RAC-7350/1014S-24; Kevlar 49 (PRD III)/Hexcel F161. The laminates were subjected to the following tests: tension, fatigue, compression, in-plane shear, flexural and interlaminar shear, and bearing stress.
Author (GRA)

N78-11202# Lockheed-California Co., Burbank. Rye Canyon Research Lab.
ASCERTAINMENT OF THE EFFECT OF COMPRESSIVE LOADING ON THE FATIGUE LIFETIME OF GRAPHITE EPOXY LAMINATES FOR STRUCTURAL APPLICATIONS Final Technical Report, 13 Feb. 1975 - 22 Sep. 1976
J. T. Ryder and E. K. Walker Wright-Patterson, AFB, Ohio AFAL Dec. 1976 271 p refs
(Contract F33615-75-C-5118)
(AD-A043365; AFML-TR-76-241) Avail: NTIS HC A12/MF A01 CSCL 11/4

The main objective of this research investigation was the experimental determination of the effect of compressive loading on the fatigue response of graphite/epoxy laminates. The primary emphasis of the program was on the accumulation of a statistically significant data base. The data base was to be used for developing an analytical model with predictive capability to account for the effect of compressive loading. The test program included only unnotched coupons in a room temperature, laboratory air environment. The test program consisted of static tensile and compressive tests; tension-tension and tension-compression fatigue tests; and tensile and compressive residual strength tests of coupons tested either under tension-tension or tension-compression fatigue loading. The development of a large, statistically meaningful data base was accomplished. The general effect of compression on the fatigue response of a graphite/epoxy composite was determined. However, a general model with capability to account for compressive loading was not attempted. As an alternate, the concept of a fatigue threshold was postulated along with consideration of some substantiating data. Analysis of the data showed that due to the extent of data scatter, a model of the 'wear-out' or similar type would predict the need for unacceptably low stress levels to achieve the high probabilities of survival required for aircraft structures.
Author (GRA)

N78-11203# Ion Physics Corp., Burlington, Mass.
ELECTRON BEAM TESTING FOR CARBON DYNAMIC RESPONSE PROGRAM (CADRE) Final Report
Robert D. Evans May 1977 131 p refs Prepared in cooperation with Avco Systems Div., Wilmington, Mass.
(Contract F29601-73-C-0075)
(AD-A043433; IPC-7604-TR-447; AFML-TR-76-1) Avail: NTIS HC A07/MF A01 CSCL 11/4

Electron beam testing performed under the Carbon Dynamic Response Program is described. Results are presented for a simulated tape wrapped carbon phenolic and for a three dimensional carbon-carbon composite.
Author (GRA)

N78-11204# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Kunststoffe.
STRENGTH INVESTIGATIONS FOR THE APPLICATION OF FIBER REINFORCED PLASTICS TO AERONAUTICAL EQUIPMENT FITTINGS [FESTIGKEITSUNTERSUCHUNGEN ZUM EINSATZ FASERVERSTAERKTER KUNSTSTOFFE FUER BESCHLAGTEILE VON LUFTFAHRTGERAET]
M. Gaedke and H. J. Hesselbrock 18 Dec. 1975 85 p refs In GERMAN; ENGLISH summary
(DLR-IB-152-75/25) Avail: NTIS HC A05/MF A01

Results of technological and experimental investigations of unidirectional filament wounded rings and loops with various geometrical shapes and different reinforced materials such as glass fibers, carbon fibers, and polyamide (Kerlar) fibers, are reported. For critical examination of different fittings a quality

factor was defined. This comparison factor representing the ratio of fracture load to fitting weight shows more favorable values for fittings out of reinforced than out of metal material. Another advantage is the higher energy of deformation for these materials. Author (ESA)

N78-11205# Bristol Univ. (England). Dept. of Mechanical Engineering.
THE INFLUENCE OF GRINDING BURN DAMAGE ON THE FATIGUE BEHAVIOUR OF NIMONIC C1023 B.S. Thesis
N. J. Campion and G. W. Hoskins Jun. 1977 50 p refs
(BU-77/C.2) Avail: NTIS HC A03/MF A01

An assessment of the fatigue behavior of ground Nimonic C1023 is presented. Specimens were produced by cylindrical plunge grinding and tested using rotating bending fatigue machines. Initially, the behavior of unburnt, 'sparked-out' specimens was to be compared to that of severely burnt specimens. The burn damage was investigated using hardness tests and microscopic examination and the chemical damage was found to be less severe than damage previously observed in creep-feed grinding workpieces; surface cracks observed in creep-feed burn were not found in the fatigue specimens and it is suggested that it was the size and geometry of the specimens which prevented their formation. The damage was limited to surface discoloration and a subsurface softening. This caused an insignificant reduction in fatigue performance which suggests that the present rejection criterion of surface discoloration for ground Nimonic components is too conservative. Author (ESA)

N78-11981# European Space Agency, Paris (France).
HIGH VOLTAGE ELECTRON MICROSCOPY. IN SITU INVESTIGATION OF PLASTIC DEFORMATION MECHANISMS
Roger Valle *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-3 (ESA-TT-356 Nov. 1976 p 67-100 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-3, May - Jun. 1976 p 157-170 Original report in FRENCH previously announced as A76-41128 (For availability see N78-11977 02-99)
Avail: NTIS HC A07/MF A01

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N78-11206 North Carolina Univ., Chapel Hill.
OPTIMIZATION STRATEGIES FOR THE ANALYSIS OF CHEMICAL DATA Ph.D. Thesis
Garry Lee Ritter 1976 207 p
Avail: Univ. Microfilms Order No. 77-17368

There are two occasions during a chemical experiment when minimizing or maximizing procedures can be applied. In the first the analyst wishes to find the set of conditions which maximizes the information he can obtain from the experiment. The other use of optimization starts after the data has been collected. Methods are described for the optimization of this analysis of the experimental data. Applications of optimization techniques in pattern recognition are described. Algorithms are then presented for the solution of two chemical problems. In the first, clustering method is applied to gas chromatographic liquid phases. The second problem arises from the need for rapid methods of searching large data collections. A simple binary search is investigated for a file of gas chromatographic liquid phases and for a large set of mass spectra. Dissert. Abstr.

N78-11207 Pennsylvania State Univ., University Park.
QUALITATIVE AND QUANTITATIVE STUDIES OF VOLATILES FROM COAL PYROLYSIS USING MASS SPECTROMETRY AND GAS CHROMATOGRAPHY Ph.D. Thesis
Gerald Oscar Tremblay 1977 86 p
Avail: Univ. Microfilms Order No. 77-17732

Type analysis was used to analyze the mass spectra. Mass spectrometric analysis of the products resulting from the pyrolysis in vacuo showed water, nitrogen, carbon monoxide, carbon dioxide, and straight chain hydrocarbons both saturated and mono-unsaturated up to about a seven carbon chain length. Also two major aromatic series appeared, benzene and naphthalene, methylated to differing extents. It was found that with increasing temperature mono-unsaturates were predominant over saturates and polyunsaturates. Only one of the two coals contained pyrite and that one yielded sulfur dioxide on pyrolysis. Hydrogen sulfide was evident from the pyrolyses of both coals that contained organic sulfur in equal percentages. The gas chromatograph was used to obtain quantitative product distributions from the coal pyrolyses in helium. Ethene, ethane, propene, and propane were analyzed. Dissert. Abstr.

N78-11208*# National Aeronautics and Space Administration, Washington, D. C.
PHYSICAL-CHEMICAL EXAMINATION OF THE N2O3-SO3-H2O SYSTEM
C. Linstroem and G. Malyska Sep. 1977 7 p refs Transl. into ENGLISH from Z. Chem. (West Ger.), v. 8, no. 9, 1968 p 345-346 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Carl Schlorhemmer Chem. Tech. Univ. (West Germany)
(Contract NASw-2790)
(NASA-TM-75169) Avail: NTIS HC A02/MF A01 CSCL 07D

It was found that when (NO)HSO4 is added to absolute H2SO4, specific conductivity rises sharply, possibly due to an increase in mutual interionic effects and viscosity as the (NO)HSO4 concentration rises. The addition of SO3 to the solution yielded a precipitate; a combination of analysis, IR spectroscopy and X-ray diffraction techniques indicated that this precipitate was (NO)HS2O7. Author

N78-11209*# National Aeronautics and Space Administration, Washington, D. C.
PHOTOCATALYTIC OXIDATION MECHANISM OF ISOBUTANE IN CONTACT WITH TITANIUM DIOXIDE (TiO2)
M. Formenti, F. Juillet, and S. J. Teichner Sep. 1977 18 p refs Transl. into ENGLISH from Bull. Soc. Chim. France, no. 9-10, 1976 p 1315-1320 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75197) Avail: NTIS HC A02/MF A01 CSCL 07D

The photocatalytic oxidation of isobutane to acetone in the presence of irradiated ultraviolet irradiated titanium dioxide was found to occur in several steps. Insertion of an oxygen atom onto the tertiary carbon transforming the isobutane into tertiary butanol occurred first. This step implied the photonic formation of the O2- species and its reaction with positive holes. The tertiary butanol was then dehydrated to isobutene which is oxidized acetone and carbon dioxide. Insertion of an oxygen atom onto the primary carbon led to isobutanal after oxidation to the alcohol. An analogous reaction scheme was proposed for all alkanes. Author

N78-11210*# National Aeronautics and Space Administration, Washington, D. C.
PHOTOCATALYTIC OXIDATION MECHANISM OF ALKANES IN CONTACT WITH TITANIUM DIOXIDE
M. Formenti, F. Juillet, and S. J. Teichner Sep. 1977 22 p refs Transl. into ENGLISH from Bull. Soc. Chim. France, no. 7-8, 1976 p 1032-1036 In FRENCH and ENGLISH Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75198) Avail: NTIS HC A02/MF A01 CSCL 07D

Isobutane was photooxidized on titanium dioxide between -16 and +180 C in tertiary butanol and acetone. The formation of tertiary butanol preceded the formation of acetone. Above 20 C the latter compound became clearly predominant. The reaction kinetics obeyed a steady state model of oxygen chemisorption with the involvement of isobutane in the physisorbed phase. Author

N78-11211*# National Aeronautics and Space Administration, Washington, D. C.

CHANGE IN THE THERMIONIC WORK FUNCTION OF SEMICONDUCTOR POWDERS EXPOSED TO ELECTROMAGNETIC RADIATION

S. Bourasseau, J. R. Martin, F. Juillet, and S. J. Teichner Sep. 1977 22 p refs Transl. into ENGLISH from J. Chim. Phys. (Paris), no. 7-8, 1974 p 1017-1024 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.

(Contract NASw-2791)

(NASA-TM-75199) Avail: NTIS HC A02/MF A01 CSCL 07D

The variations of the thermoelectronic work function of titanium dioxide, submitted to an ultraviolet or visible and infrared radiation, in the presence of oxygen, are studied by the vibrating condenser method. It is shown that during the ultraviolet irradiation, a desorption of a first species of oxygen simultaneously occurs with the adsorption of a second species of oxygen and that this phenomenon is found for any structure of TiO2 (anatase or rutile) any texture, oxygen pressure, radiation intensity, and nature of introduced dopes. Author

N78-11212*# National Aeronautics and Space Administration, Washington, D. C.

VARIATION IN THE THERMIONIC WORK FUNCTION OF SEMICONDUCTOR POWDERS EXPOSED TO ELECTROMAGNETIC RADIATION

S. Bourasseau, J. R. Martin, F. Juillet, and S. J. Teichner Sep. 1977 13 p refs Transl. into ENGLISH from J. Chimie Phys. (France), no. 7-8, 1974 p 1025-1027 Transl. by Scientific Translation, Inc., Santa Barbara, Calif.

(Contract NASw-2791)

(NASA-TM-75200) Avail: NTIS HC A02/MF A01 CSCL 07D

The study of the variation of thermoelectronic work function potential of TiO2 in the presence of isobutane shows that this gas is not adsorbed on this solid, in either the presence or the absence of ultraviolet radiation. These results, as well as those obtained in a previous work, lead to the mechanism of the photo-oxidation of isobutane at room temperature, in which excited atomic oxygen is the active species. Author

N78-11213*# National Aeronautics and Space Administration, Washington, D. C.

SOLUBILIZATION OF COAL IN ORGANIC MEDIA

Ph. Lahaye and D. Decroocq Jun. 1977 44 p refs Transl. into ENGLISH from Solubilisation Du Charbon en Milieu Organique, Revue De l'Institut Francais de Petrole 31 (France), no. 1, Jan. - Feb. 1976 p 99-130 Original language document was announced as A76-46522 and N77-27498 Transl. by Scitran, Santa Barbara, Calif.

(NASA Order JE-654698)

(NASA-TM-75118) Avail: NTIS HC A03/MF A01 CSCL 07D

Study of the extraction of coal by organic solvents at moderate temperature has allowed us to understand the experimental conditions which will lead to a maximum yield of extract. Based on the results obtained on the effect of the nature of the solvent, it appears to be desirable in reaching this result to make use of binary mixtures or possibly of even more complex ones composed of amines or, more generally, of basic nitrogen-containing compounds. The use of the solvents discussed above was also considered for treatment of kerogen or the organic material contained in sedimentary rocks. Only 10 to 40% of the organic material was extracted from the samples. However, the chemical structure of kerogens is much more varied than that of coals, so it can be expected that kerogens which have undergone a strong evolution through the action of geologic conditions will maintain their very low solubilities, whatever the solvent used. Author

N78-11214*# National Aeronautics and Space Administration, Washington, D. C.

INORGANIC CHEMISTRY: DIRECT SYNTHESES FROM PURE LIQUID SO3 AND FROM TRIVALENT AND PENTAVALENT NITROGEN DERIVATIVES

B. Vandorpe and J. Heubel Sep. 1977 7 p refs Transl. into ENGLISH from Compt. Rend., v. 260, group 8, 21 Jun. 1968 p 6619-6621 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original Doc. prep. by Faculty of Sciences, Lille (France).

(Contract NASw-2790)

(NASA-TM-75171) Avail: NTIS HC A02/MF A01 CSCL 07D

From pure liquid SO3 direct synthesis reactions were carried out with N2O5, NO2Cl, NOCl which yielded N2O54SO3, 3SO3, 2SO3-NO2Cl2SO3-NOCl2SO3 and NOCl2SO3, the latter being obtained for the first time in the pure state. In all cases the crystallized product was obtained by separating the constituents of the mixture and then going through a single viscous liquid phase. Author

N78-11215# Eidgenoessische Technische Hochschule, Zurich (Switzerland).

PHASE TRANSITIONS AND TRICRITICAL POINTS: AN EXACTLY SOLUBLE MODEL FOR MAGNETIC OR DISTORTIVE SYSTEMS Ph.D. Thesis

Stephane Sarbach 1976 166 p refs

(ETH-5692) Avail: NTIS HC A08/MF A01

An existing Hamiltonian model describing structural or magnetic phase transitions (classical spin model) is defined and its interpretation and known results are explored. The dependence of the ground state on model parameters is discussed as well as the so-called Ising limit. An exactly soluble model is introduced which permits calculation of all thermodynamic functions and exhibits a nontrivial critical behavior. The existence of a tricritical point is demonstrated, and the tricritical exponents are identical with those determined by renormalization-group calculations for the original Hamiltonian model. Author

N78-11216*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

IMPROVEMENTS IN MICROELECTROPHORETIC APPARATUS AND PROCESS Patent Application

Benjamin W. Grunbaum, inventor (to NASA) (Calif. Univ., Berkeley) Filed 10 Nov. 1977 32 p Sponsored by NASA

(NASA-Case-ARC-11121-1; US-Patent-Appl-SN-850507) Avail: NTIS HC A03/MF A01 CSCL 07D

Gel tray and lid assemblies designed for use in conjunction with slotted electrophoretic membranes were developed to take advantage of improved microelectrophoretic accessories, which include a multisample applicator capable of applying up to 10 samples consecutively or simultaneously, and a temperature control plate for dissipating the heat produced by electrophoresis in a gel. The trays and membranes can be marketed ready for use as electrophoretic media or impregnated with various specific substrates and dyes which can develop the electrophoretic patterns of up to 30 individual protein samples in up to 10 tray or membrane compartments. In addition to greatly simplifying and speeding up electrophoresis, these methods and equipment can contribute to the standardization of processes for clinical, forensic and anthropological diagnosis and identification. NASA

N78-11217# Eidgenoessische Technische Hochschule, Zurich (Switzerland).

INFRARED SPECTROSCOPIC STUDIES ON THE OZONE-ETHYLENE REACTION IN THE LIQUID AND GAS PHASES Ph.D. Thesis [IR-SPEKTROSKOPISCHE UNTERSUCHUNG DER OZON-AETHYLEN REAKTION IN DER FLUESSIGEN PHASE UND IN DER GASPHASE]

Heinz Kuehne 1976 130 p refs In GERMAN; ENGLISH summary

(ETH-5713) Avail: NTIS HC A07/MF A01

Infrared and far infrared spectra of four isotopic modifications of secondary ethylene ozonide isolated in solid argon matrix have been analyzed. Assignments are given for the vibrational spectra based on both empirical arguments and normal coordinate analysis. For the latter a 30 parameter harmonic force field is reported and a detailed analysis of the Fermi resonance involving the CH2 stretching and bending modes is presented. Statistical thermodynamic functions of the parent species (12C2 1H4 1603) are tabulated. Furthermore the gas phase reaction of ethylene with ozone in a large excess of Argon at total pressure of about 600 Torr have been investigated by infrared matrix spectroscopy coupled with a linear reactor. Besides well known products of this reaction formic anhydride and glycol aldehyde have been detected. Some possible reaction pathways leading to the observed molecules are suggested using ab initio and thermochemical data. Author

N78-11218# United Technologies Research Center, East Hartford, Conn.

CALCULATION OF POTENTIAL ENERGY CURVES FOR METAL OXIDES AND HALIDES Final Report, 1 Jun. 1973 - 31 Mar. 1977
H. Harvey Michels May 1977 50 p refs
(Contract F44620-73-C-0077; AF Proj. 9538)
(AD-A043241; UTRC/R77-921723-1; AFOSR-77-0937TR) Avail: NTIS HC A03/MF A01 CSCL 20/12

The research performed under this contract was directed toward the calculation of the electronic structure and radiative transition probabilities for certain diatomic metal oxides and halides which are candidate visible/UV laser systems. The objectives were to uncover systems having a low-lying excited state with a reasonably long (=10 microsec) radiative lifetime and situated energetically such that an inversion of population with respect to the dominant transitions to the ground state was possible. The systems under investigation to date include the group IIA metal oxides (BeO-BaO), the group IVA metal oxides (CO-PbO), NF, SiF, AlF and the thirteen electron sequence: N2(+), CN, CO and BeF. These latter systems have a common chemistry of their electronically excited states. Among these molecules the systems BaO, BO, NF, SnO, SiF and AlF were chosen for detailed study. Their value as candidate visible/UV laser systems has been analyzed. GRA

N78-11219# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
IMPROVING THE ANALYTICAL ACCURACY OF ELECTRON SPIN RESONANCE SPECTROMETRY Technical Report, 1 Jul. - 20 Aug. 1977
Ira B. Goldberg 22 Aug. 1977 18 p refs
(Contract N00014-73-C-0325)
(AD-A043565; SC549.26TR; TR-10) Avail: NTIS HC A02/MF A01 CSCL 20/3

Sources of error in Analytical Electron Spin Resonance Spectrometry are discussed. Errors due to gain of the lock in amplifiers and modulation amplitude settings can be reduced if the settings are properly calibrated or if the attenuators are rebuilt. It is also necessary that the incident microwave power level is monitored and that the cavity is reproducibly tuned. A method of correction for incomplete integration of Lorentzian lines is discussed. GRA

N78-11220# Chicago Univ., Ill.
CO2 PRODUCT VELOCITY DISTRIBUTION FOR CO OXIDATION ON PLATINUM
Charles A. Becker, James P. Cowin, Lennard Wharton, and Daniel J. Auerbach Jul. 1977 9 p refs
(Contract N00014-77-C-0240; Grant AF-AFOSR-3186-77)
(AD-A043532) Avail: NTIS HC A02/MF A01 CSCL 07/4

It has been inferred from the very peaked angular distribution of the CO2 formed by catalytic oxidation of CO on Pt(111) that the product CO2 is desorbed with excess translational kinetic energy. The first direct measurement of the CO2 velocity distributions and angular distributions for this reaction on polycrystalline Pt are reported. These qualitatively confirm the inference and give quantitative information. For CO2 desorbing in the normal direction the most probable velocity was 116000 cm/sec, implying a kinetic energy of E/k = 3560 K. At larger angles from the surface normal the most probable velocity decreases monotonically. At 45 degrees it is 90000 cm/sec for a kinetic energy of E/k - 2140 degrees.
Author (GRA)

N78-11221# Colorado State Univ., Fort Collins. Dept. of Chemistry.
OPTICAL AND ZERO FIELD MAGNETIC RESONANCE SPECTROSCOPY OF INORGANIC MOLECULAR SOLIDS Final Report, 1 Jun. 1975 - 31 May 1977
Elliot R. Bernstein Jul. 1977 8 p refs
(Grant DAAG29-75-G-0161)
(AD-A043340; ARO-13261.1-C) Avail: NTIS HC A02/MF A01 CSCL 07/2

Optical and magnetic resonance investigations of inorganic molecular solids were performed. Raman and zero field magnetic resonance were studied for XF6 (X = U, Mo, W, Re, Ir) and M(BH4)4 (M = Zr, Hf, U) in order to learn about energy transfer, relaxation, and molecular solid state dynamics.
Author (GRA)

N78-11222# Colorado State Univ., Fort Collins. Dept. of Chemistry.
ELECTROCHEMISTRY OF Ni (2) AND THE BEHAVIOR OF OXIDE IONS IN CHLOROALUMINATE MELTS
Bernard Gilbert and R. A. Osteryoung Aug. 1977 38 p refs
(Contract N00014-77-C-0004)
(AD-A043421; TR-4) Avail: NTIS HC A03/MF A01 CSCL 07/4

The electrochemical behavior of Ni(II) has been investigated in chloroaluminate melts between 145 and 210 deg C. Ni(II) is completely soluble in acidic mixtures where the pCl is higher than 5.5 (m/Kg scale). A well defined and behaved reduction wave is observed at 1.2 V vs an Al reference in a NaCl saturated reference compartment. When the pCl is descreased, precipitation of NiCl2 occurs, the result which has been confirmed from electrochemical and X-ray diffraction experiments. The solubility product was found. The result is in disagreement with the precipitation of NiO which was recently proposed in the literature. As a direct consequence, the acid-base behavior of oxide ions in chloroaluminate has been reinvestigated. Precise titrations of the basic strength of oxide ions have been performed in narrow pC1 ranges. An equilibrium constant of .016/m Kg was found for the general reaction in equilibrium with two orders of magnitude higher than the previously reported value. GRA

N78-11223# Ballistic Research Labs., Aberdeen Proving Ground, Md.
BURNING RATES OF STANDARD ARMY PROPELLANTS IN STRAND BURNER AND CLOSED CHAMBER TESTS
Bertram B. Grollman and Carl W. Nelson Aug. 1977 37 p refs
(DA Proj. 1T-61102-H-53)
(AD-A043778; BRL-MR-2775) Avail: NTIS HC A03/MF A01 CSCL 19/1

Burning rate data determined over twenty years ago at the Ballistic Research Laboratory (BRL) and disseminated to only a limited audience have been referenced in several recent reports. This report provides a complete compilation of the experiments, the data, and the analyses to provide a usable reference for current investigations. It compares strand burner and closed chamber rates for the same propellant. Standard army gun propellants (M1, M2, M5, M6, M8, M10, and M17) were re-extruded into 3mm (1/8 in.) and 6mm (1/4 in.) strands for strand burner tests at pressures of 3.4 to 310 MPa (500 to 45,000 psi) and in closed chamber tests at densities of loading (delta) of 0.089, 0.174, and 0.258 g/cc. Fifteen additional lots of standard propellants were tested in the closed chamber at densities of loading of 0.084 and 0.140 g/cc. The report presents the raw data, method of calculation for burning rate, and coefficients for various burning rate equations. The report also proposes an empirical relationship between the propellant flame temperature, and the burning rate parameters. Author (GRA)

N78-11224# National Academy of Sciences - National Research Council, Washington, D. C. Advisory Center on Toxicology.
FIRE TOXICOLOGY: METHODS FOR EVALUATION OF TOXICITY OF PYROLYSIS AND COMBUSTION PRODUCTS
Aug. 1977 34 p refs
(Contract N00014-75-C-0718)
(AD-A043899; NAS/ACT/P-843-2) Avail: NTIS HC A03/MF A01 CSCL 06/20

After reviewing methods currently being used for evaluating the toxicity of pyrolysis/combustion products, the Committee has concluded that acceptable screening tests for evaluating these toxicities are not currently available, as all present methods have one or more shortcomings. The Committee has prepared guidelines for developing the needed methodology and has made recommendations for additional research. Author (GRA)

N78-11225# National Bureau of Standards, Washington, D. C. Inst. for Materials Research.
A BIBLIOGRAPHY OF SOURCES OF EXPERIMENTAL DATA LEADING TO ACTIVITY OR OSMOTIC COEFFICIENTS FOR POLYVALENT ELECTROLYTES IN AQUEOUS SOLUTION Final Report
R. N. Goldberg, B. R. Staples, R. L. Nuttall, and R. Arbuckle Jul. 1977 58 p

(PB-270367/6; NBS-SP-485; LCCCN-77-24537) Avail: NTIS HC A04/MF A01 CSCL 07D

A bibliography of sources of experimental data that can be used to calculate either activity or osmotic coefficients in water is presented. The data types included are electromotive force measurements on cells with and without transference, vapor pressure data (relative and absolute), ultracentrifuge measurements, diffusion measurements, and other miscellaneous techniques. The compounds are give according to the standard thermochemical order of arrangement and references to the primary literature are included. GRA

N78-11226# Boston Univ., Mass.
ELECTRON TRANSFER REACTIONS OF EXCITED DYES WITH METAL COMPLEXES Progress Report, 1 May 1976 - 31 Jan. 1977
N. N. Lichtin Feb. 1977 8 p refs
(Contract EY-76-S-02-2889)
(COO-2889-1) Avail: NTIS HC A02/MF A01

The factors which determine quantum efficiency of transfer of reducing equivalents between excited dye molecules and metal complexes in their ground state, and composition and dynamics of formation and decay of related photostationary states were studied. A ruby laser capable of delivering a 3.6 J, 19 nsec flash was acquired and assembly of an apparatus for laser flash photolysis begun. At the same time, conventional flash photolysis was used to pursue investigation of the dependence upon solvent, anions, pH, and ionic strength of the kinetics of the spontaneous dark reaction of Fe(H2O)(3x)sub 6 with leucothionine and with semithionine, reactions which contribute to the composition and dynamics of formation and decay of the photostationary state of the iron-thionine photoredox reaction. Results are consistent with formation of an intermediate complex between leucothionine and Fe(III). ERA

N78-11227# Oak Ridge National Lab., Tenn.
SOLGASMIX-PV: A COMPUTER PROGRAM TO CALCULATE EQUILIBRIUM RELATIONSHIPS IN COMPLEX CHEMICAL SYSTEMS
T. M. Besmann Apr. 1977 37 p
(Contract W-7405-eng-26)
(ORNL/TM-5775) Avail: NTIS HC A03/MF A01

The use of the computer program SOLGASMIX-PV for calculating equilibrium compositions is described. The program can calculate equilibria in systems containing a gaseous phase, condensed phase solutions, and condensed phases of invariant or variable stoichiometry. Either a constant total gas volume or a constant total pressure can be assumed. Unit activities for condensed phases and ideality for solutions are assumed, although nonideal systems can be handled provided activity coefficient relationships are available. ERA

N78-11228# National Physical Lab., Teddington (England). Div. of Chemical Standards.
THERMODYNAMIC PROPERTIES OF SINGLE SUBSTANCES AND DEFINED MIXTURES: A SUMMARY OF THE MEASUREMENT AND DATA ACTIVITIES OF THE DIVISION OF CHEMICAL STANDARDS
I. J. Lawrenson, comp. Jun. 1977 13 p
(NPL-CHEM-71) Avail: NTIS HC A02/MF A01

Activities in the field of chemical and metallurgical thermodynamics are described. Topics dealt with are measurement of pressure-volume-temperature relations; properties of liquid mixtures; measurement of thermal properties; and transport properties. ESA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N78-11229 Columbia Univ., New York.
AN ANALYSIS OF VISCO-PLASTIC BEHAVIOR OF METALS Ph.D. Thesis
Natverlal Ranchhodbhai Patel 1977 61 p
Avail: Univ. Microfilms Order No. 77-17656

The inelastic behavior of polycrystalline metals is deduced from microscopic slip mechanisms in individual crystals. Assuming that the cause of inelastic strain is motion of dislocations, strain-rate equations for a slip system in a crystal are compiled. These equations take into account strain-dependent mobile dislocation density, strain hardening, and a nonlinear dependence of dislocation velocity on resolved shear stress. A model of interaction between crystal grains in the aggregate is established by utilizing the concept of a spherical inclusion in a homogeneous matrix. The resulting system is solved numerically for some typical cases of loading of a specimen in uniaxial tension, at room temperature. Quantitative comparison of the theoretical results with the experimental data for two cases of loading (static and dynamic tension tests and a stress relaxation test) reveal good agreement between the theoretical and experimental curves.
Dissert. Abstr.

N78-11230*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SECONDARY-ELECTRON-EMISSION PROPERTIES OF CONDUCTING SURFACES WITH APPLICATION TO MULTISTAGE DEPRESSED COLLECTORS FOR MICROWAVE AMPLIFIERS
Ralph Forman Nov. 1977 33 p refs
(NASA-TP-1097; E-9233) Avail: NTIS HC A03/MF A01 CSCL 11F

To improve the efficiency of high power microwave tubes, low secondary electron yield electrode surface for use in depressed collectors are needed. The secondary emission characteristics of a number of materials were investigated. The materials studied were beryllium, carbon (soot and pyrolytic graphite), copper, titanium carbide, and tantalum. Both total secondary yield delta and relative reflected primary yield were measured. These measurements were made in conjunction with Auger spectroscopy so that the secondary emission characteristics could be determined as a function of surface contamination or purity. The results show that low atomic weight elements, such as beryllium and carbon, have the lowest reflected primary yield and that roughening the surface of an electrode can markedly decrease secondary yield both for delta and reflected primaries. All factors considered, a roughened pyrolytic graphite surface showed the greatest potential for use as an electrode surface in depressed collectors. Author

N78-11231*# National Aeronautics and Space Administration, Washington, D. C.
EVOLUTION OF ION EMISSION YIELD OF ALLOYS WITH THE NATURE OF THE SOLUTE. 2: INTERPRETATION
G. Blaise and G. Slodzian Nov. 1977 44 p refs Transl. into ENGLISH from J. Phys. (Paris), v. 35, no. 3, Mar. 1974 p 243-261 Original language document was announced as A74-26212 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by CNRS
(Contract NASw-2790)
(NASA-TM-75180) Avail: NTIS HC A03/MF A01 CSCL 11F

Solid solutions of transition elements in copper, nickel, cobalt, iron, and aluminum matrices were analyzed by observing secondary ion emissions under bombardment with 6.2-keV argon ions. Enchancement of the production of solute-element ions was observed. An ion emission model is proposed according to which the ion yield is governed by the probability of an atom leaving the metal in a preionized state. The energy distribution of the valence electrons of the solute atoms is the basis of the probability calculation. Author

N78-11232*# General Electric Co., Cincinnati, Ohio. Material and Process Technology Labs.
MANUFACTURE AND ENGINE TEST OF ADVANCED OXIDE DISPERSION STRENGTHENED ALLOY TURBINE VANES Final Report
P. G. Bailey Oct. 1977 158 p refs
(Contract NAS3-18915)
(NASA-CR-135269; R77AEG569) Avail: NTIS HC A08/MF A01 CSCL 11F

Oxide-Dispersion-strengthened (ODS) Ni-Cr-Al alloy systems were exploited for turbine engine vanes which would be used for the space shuttle thermal protection system. Available commercial and developmental advanced ODS alloys were

evaluated, and three were selected based on established vane property goals and manufacturing criteria. The selected alloys were evaluated in an engine test. Candidate alloys were screened by strength, thermal fatigue resistance, oxidation and sulfidation resistance. The Ni-16Cr (3 to 5)Al-ThO2 system was identified as having attractive high temperature oxidation resistance. Subsequent work also indicated exceptional sulfidation resistance for these alloys. G.D.H.

N78-11233# Eidgenoessische Technische Hochschule, Zurich (Switzerland).

ANISOTROPIC RELAXATION TIMES IN THE TRIVALENT METALS ALUMINUM AND INDIUM Ph.D. Thesis

Willem VanderMark 1976 114 p refs

(ETH-5674) Avail: NTIS HC A06/MF A01

The anisotropy of the conduction electron relaxation times, in the context of conduction phenomena, i.e. resistivity and Hall effect is examined. The influence of impurities introduced, substitutionally, in an otherwise ideal metal is explained. The developments leading toward the concept of anisotropic relaxation times are discussed, and the reasons why only the simple trivalent metals are treated, is presented. Author

N78-11234# Eidgenoessische Technische Hochschule, Zurich (Switzerland).

ELECTRONIC TRANSPORT PROPERTIES OF TRANSITION METALS AND METAL ALLOYS OF TRANSITION IN A LIQUID AND AMORPHOUS STATE Ph.D. Thesis [PROPRIETES DE TRANSPORT ELECTRONIQUE DE METAUX DE TRANSITION ET D'ALLIAGES DE METAUX DE TRANSITION A L'ETAT LIQUIDE ET AMORPHE]

Mueller Rene 1976 52 p refs In FRENCH; ENGLISH summary

(ETH-5848) Avail: NTIS HC A04/MF A01

The Hall-coefficients of transition metals such as Ni and Co, and alloys of a transition metal with a rare-earth element such as Co-Ce were measured at high temperatures in the solid and liquid state. The Co-Ce alloys show in the middle of the concentration range, where the localized 4f electrons of Ce have disappeared a negative sign of the Hall-coefficient, whereas the pure liquid components Co and Ce have both a positive sign. New measurements of the electrical resistivity of pure liquid transition metals such as Fe, Co, Ni and Pd were performed and compared with theoretical results based on the Ziman theory by taking into account d resonance scattering. The magnitude of the electrical resistivity and its temperature coefficient for transition metal alloys in the glassy and liquid state are similar, suggesting that an extension of the Ziman theory in the t-matrix approximation to glassy alloys of transition metals may be very useful for interpreting the experimental data. Author

N78-11235# Army Tank-Automotive Research and Development Command, Warren, Mich.

DEVELOPMENT OF QUALITY ASSURANCE TRAINING MANUAL TO ASSIST IN ESTABLISHING SOUNDNESS REQUIREMENTS FOR ALUMINUM AND STEEL CASTINGS

Walter F. Wulf, Melvin V. Phytila, Salvatore B. Catalano, and D. Matichuk Apr. 1977 42 p

(AD-A043539; TARADCOM-TR-12256) Avail: NTIS HC A03/MF A01 CSCL 11/6

Samples of aluminum and steel casting flaws most commonly experienced in production were selected to be radiographed in order to develop quantitative and descriptive picture images or various radiographic reference standards. Graphic illustrations of flaw size and flaw distribution for various radiographic reference standards were depicted by using radiographs and associated cross-sectional photo-macrographs. These graphic illustrations of radiographic levels of acceptance will provide meaningful design criteria for establishing realistic standards of acceptance for new material applications. This report also furnishes operational guidance to quality assurance and radiographic personnel in their normal on-the-job duties. Author (GRA)

N78-11236# Boeing Aerospace Co., Seattle, Wash.

CAST ALUMINUM STRUCTURES TECHNOLOGY (CAST) Final Report, Jun. 1976 - Feb. 1977

Donald Goehler May 1977 76 p refs

(Contract F33615-76-C-3111)

(AD-A043469; D180-20526-1; AFFDL-TR-77-36) Avail: NTIS HC A05/MF A01 CSCL 01/3

The objective of CAST is to establish the necessary structural and manufacturing technologies and to demonstrate and validate the integrity, producibility, and viability of cast aluminum primary airframe structures. The baseline design is the AMST prototype YC-14 and the component selected was the Nose Landing Gear Support Bulkhead. Preliminary design activities are described that were aimed at the minimum goal of 30% acquisition cost savings with no weight penalty. Preliminary design data were developed, and a design recommended that could save 38% on cost and result in a 10-pound weight savings. Author (GRA)

N78-11237# Southwest Research Inst., San Antonio, Tex.

CRACK TIP PLASTICITY ASSOCIATED WITH CORROSION ASSISTED FATIGUE Annual Report, Jun. 1976 - Jun. 1977

David L. Davidson and J. Lankford 8 Aug. 1977 32 p refs

(Contract N00014-75-C-1038; NR Proj. 036-109)

(AD-A043686) Avail: NTIS HC A03/MF A01 CSCL 11/6

The plasticity associated with propagation of a fatigue crack was found to be altered by a moist air environment, as compared to a dry nitrogen environment. Subcell size distribution and size of the plastic zone are the parameters altered, with the moist air causing a smaller plastic zone with the resulting redistribution of subcell sizes. The energy for crack propagation has been determined by the combination of subcell size and work per cycle required to give that subcell size. This calculation indicates a decrease of 67% in the energy for crack propagation is caused by the moist environment. The moist air environment also alters fracture surface features in a manner consistent with the plasticity results. Hydrogen is believed to be responsible for these changes, in that it can: (1) make dislocation motion more difficult, and (2) decrease the strain to fracture. An effort was made to directly detect hydrogen by ion microprobe, but the results were inconclusive. Author (GRA)

N78-11238# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

CORRELATION OF MICROSTRUCTURE WITH FRACTURE TOUGHNESS PROPERTIES IN METALS, PART 3 Final Report, 11 Apr. 1975 - 10 Jan. 1977

Richard E. Lewis and Frank A. Crossley 10 Jan. 1977 145 p refs

(Contract N00019-75-C-0378)

(AD-A043741; LMSC-D555813-Pt-3) Avail: NTIS HC A07/MF A01 CSCL 11/6

Ti-6Al-4V alloy, 1-in plate was studied for the purpose of establishing a correlation between microstructures and fracture toughness, stress-corrosion cracking, and fatigue crack growth. Both standard and ELI grades, mill-annealed, vacuum-creep-furnace flattened and recrystallization-annealed were included. Reheat-treatments by duplex-annealing and beta- plus duplex-annealing were performed, including air and furnace cooling from the final annealing temperature. A total of 17 conditions were studied, complementing the 49 conditions previously studied on two contracts to Naval Air Systems Command. Tensile, fracture toughness, stress-corrosion cracking, and fatigue crack growth properties were determined. Optical microscopy and scanning electron microfractography were employed. Six conditions studied previously were reexamined by transmission electron microscopy to investigate the effect of cooling rate on the interface phase between alpha and beta phases and on development of short-range order in the alpha phase. GRA

N78-11239# California Univ., Livermore. Lawrence Livermore Lab.

INFLUENCE OF RETAINED AUSTENITE ON THE THICK SECTION MECHANICAL PROPERTIES OF A COMMERCIAL LOW ALLOY ULTRA-HIGH STRENGTH STEEL Ph.D. Thesis

R. M. Horn Dec. 1976 162 p refs

(Contract W-7405-eng-48)

(LBL-5787) Avail: NTIS HC A08/MF A01

The relationships between microstructure, mechanical, and fracture properties were investigated for thick sections following

air cooling and tempering in a silicon-modified 4340, 300-M. Slow cooling leads to high levels of retained austenite (up to 30 percent). Properties were determined for microstructures equivalent to those developed through air cooling and tempering of 2.5, 5.0, 10.0 and 15 cm thick plates. Simulated slow cooling was performed on small specimens to model the thicker sections. Fracture toughness and Charpy V-notch behavior were used to evaluate fracture properties while both round and flat tensile specimens were used to measure mechanical properties. The morphology, amount, and mechanical stability of the austenite were characterized using transmission electron microscopy and magnetic saturation techniques. It was found that the stability of the austenite, which changed with tempering treatment, had a major influence on the fracture properties. ERA

N78-11240# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Manufacturing Research and Product Development Dept.

CORROSION PREVENTIVE COATINGS FOR INTEGRAL FUEL TANKS

A. Kersting Feb. 1977 8 p

(FOK-R-2007) Avail: NTIS HC A02/MF A01

The results of tests on corrosion by fungi on fuel tank wall material are presented. Application of the simulated microbial by products resistance test (MIL-C-27725B) showed that the adhesive primers BSL 101, BR 127, and Metlbond 328 give insufficient protection while BR 227 and PR 1560M (curing at room temperature) meet specifications. ESA

N78-11241# Institut fuer Festkoerpermechanik, Freiburg (West Germany).

DEVELOPMENT OF THE SHAPE OF PART-THROUGH CRACKS Final Report

L. Hodulak, S. Kunzelmann, and E. Sommer Mar. 1977 29 p refs In GERMAN; ENGLISH summary

(Contract AIF-DECHEMA-3687)

(IFKM-W-2/77) Avail: NTIS HC A03/MF A01

The development of the crack shape during growth of part-through cracks was investigated with particular reference to the parameters related to crack resistance. Experiments on aluminum and steel specimens (Al Cu Mg1 and 22 Ni Mo Cr 37) under fatigue loading show that the development of the crack shape is also influenced by the load level and load history, but is independent of specimen thickness provided that all other parameters are correspondingly scaled. Author (ESA)

N78-11242# Royal Aircraft Establishment, Farnborough (England).

A CHEMICAL TREATMENT FOR MERCURY ACCIDENTALLY SPILLED IN AIRCRAFT

H. J. Allsopp Jan. 1977 30 p refs

(RAE-TR-77014; BR57346) Avail: NTIS HC A03/MF A01

Tests were made to determine the susceptibility of commercially pure aluminum and high strength Al-Zn-Mg-Cu and Al-Cu alloys to embrittlement by mercury. Commercially pure aluminum to BS L16 is not embrittled by mercury. DTD 5050B (Al-Zn-Mg-Cu) is very susceptible to mercury embrittlement; cracking occurred when the alloy was stressed in the short transverse direction at 5% of the 0.2% proof stress. DTD 5020A (Al-Cu) is more resistant to mercury embrittlement, although it cracked when stressed in the short transverse direction at 60% of the 0.2% proof stress. A chemical technique using silver nitrate was developed to immobilize and render relatively harmless any elemental mercury accidentally spilled in aircraft. The corrosion and stress corrosion hazards to alloys DTD 5020A and DTD 5050B, associated with silver nitrate and the products of its reaction with mercury, were investigated. Author (ESA)

N78-11243# Bristol Univ. (England). Dept. of Mechanical Engineering.

THE EFFECT OF SIMULATED SERVICE CONDITIONS ON STAINLESS STEEL TYPE 316 B.S. Thesis

J. C. W. Kent and J. A. Infield Jun. 1977 52 p refs

(BU-77/B.4) Avail: NTIS HC A04/MF A01

Materials used in high temperature applications are often subject to a departure from their virgin properties due to severe service conditions. It is therefore necessary to investigate the changes in the microstructure and mechanical properties of materials used in such applications in order to avoid premature and costly failure. The project was devised in order to determine the effect of prior damage and aging on stainless steel type 316 which is used in the construction of the fast breeder nuclear reactor. This was accomplished by subjecting prestrained, fatigued, and cold worked specimens to an accelerated aging process and observing subsequent changes in the tensile, hardness, creep, and impact properties of the material. The results obtained showed that for annealed material, irrespective of damage, the tensile strength increased with aging time after an initial period of weakening. Prior fatigue and prior strain were observed to accelerate these effects. Cold worked material tended to deteriorate continuously with aging, while the impact and hardness properties of all pretreated types of alloy decreased with aging. Author (ESA)

N78-11244# Bristol Univ. (England). Dept. of Mechanical Engineering.

AN INVESTIGATION INTO MODE 2 FATIGUE CRACK PROPAGATION B.S. Thesis

K. Payne and M. West Jun. 1977 51 p refs

(BU-77/B.8) Avail: NTIS HC A04/MF A01

Fatigue crack propagation under mode 2 opening conditions has been studied in a notched thin cylinder. A direct correlation was obtained between crack growth rates and the stress intensity range. Mode 2 has similar characteristics to mode 1 fatigue crack propagation and it is suggested that they have similar fracture mechanisms. Author (ESA)

N78-11972# European Space Agency, Paris (France).

SPECIFIC HEAT AND ELECTRONIC STRUCTURE OF COMPOUNDS AND ALLOYS OF TRANSITION METALS

Rene Caudron and Paul Costa *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-4 (ESA-TT-396) Jul. 1977 p 21-78 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-4, Jul.-Aug. 1976 p 193-215 Original report in FRENCH previously announced as A77-11157 (For availability see N78-11970 02-99)

Avail: NTIS HC A08/MF A01

N78-11973# European Space Agency, Paris (France).

APPLICATION OF ION MICROANALYSIS TO THE STUDY OF PROTECTIVE COATING ON SUPERALLOYS

Guy Thauvin, Claude Roques-Carmes, Guy Blaise, Georges Slodzian, and Robert Pichoir *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-4 (ESA-TT-396) Jul. 1977 p 79-116 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-4, Jul.-Aug. 1976 p 217-232 Original report in FRENCH previously announced as A77-11158 (For availability see N78-11970 02-99)

Avail: NTIS HC A08/MF A01

N78-11990# European Space Agency, Paris (France).

INFLUENCE OF OVERAGING AT 175 C ON THE FATIGUE CRACK GROWTH RATE OF A 7075 ALUMINUM ALLOY

Guy Ramusat and Georges Vidal *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-1 (ESA-TT-407) Sep. 1977 p 134-140 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-1, Jan.-Feb. 1977 p 63-66 Original report in FRENCH previously announced as A77-27745 (For availability see N78-11984 02-99)

Avail: NTIS HC A07/MF A01

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N78-11245*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ELECTRICALLY CONDUCTIVE THERMAL CONTROL COATINGS Patent Application

Michael Charles Shai, inventor (to NASA) Filed 21 Oct. 1977 16 p

(NASA-Case-GSC-12207-1; US-Patent-Appl-SN-844344) Avail:

NTIS HC A02/MF A01 CSCL 11G

A coating characterized by low thermal absorption, high thermal emittance and high electrical conductivity was developed. The paint composition or coating comprises a fired oxide pigment having a minor amount of aluminum oxide and a major amount of zinc oxide, an alkali metal silicate vehicle-binder, and sufficient water to provide a mixture suitable for application to a substrate. The fired oxide pigment may further include a minor amount of cobalt oxide. The resulting coating is particularly useful for coating the surfaces of spacecraft and similar objects. NASA

N78-11246# Naval Civil Engineering Lab., Port Hueneme, Calif.
FUNGAL-RESISTANT ORGANOTIN PAINTS Technical Note, Jul. 1975 - Sep. 1976
Richard W. Drisko, Thomas B. O'Neill, and Lee K. Schwab May 1977 36 p
(YF54593012)
(AD-A043366; CEL-TN-1480) Avail: NTIS HC A03/MF A01 CSCL 11/3

Fifteen experimental paint formulations were prepared from three organotin alkyd resins. Laboratory chamber testing (ASTM D3273-73T) and field testing of these paints at Puerto Rico have shown varying degrees of resistance to mildew growth. Thirty-two different microorganisms were isolated from the painted panels at Puerto Rico and identified in the laboratory. In a laboratory study, triphenyltin compounds useful in paint vehicles were found to be almost as effective as corresponding tributyltin compounds in controlling mildew growth and may be much safer to handle. An organotin compound was found to provide mildew resistance to a chlorinated rubber formulation (TT-P-95, Type I) that is useful on many masonry and concrete surfaces. Author (GRA)

N78-11247# TRW, Inc., Cleveland, Ohio.
ULTRASONIC INSPECTION OF CERAMICS CONTAINING SMALL FLAWS Final Technical Report, 19 Feb. 1976 - 18 Feb. 1977
Thomas Derkacs, Istvan M. Matay, and William D. Brentnall Mar. 1977 84 p refs
(Contract N62269-76-C-0148)
(AD-A043959; TRW-ER-7867-F) Avail: NTIS HC A05/MF A01 CSCL 11/2

A 45 MHz ultrasonic shear wave technique was developed and evaluated for detection of small defects, less than 100 micro m(0.004 inches), in gas turbine quality ceramics. Results for the shear wave technique were compared with the results for the previously developed 45 MHz longitudinal wave technique on hot pressed silicon nitride and silicon carbide from two vendors and on boron-doped sintered silicon carbide. Conventional mechanical tests were also performed to verify defect sizes and types and to correlate material strength with ultrasonic inspection results. The shear wave technique was found to have better sensitivity than the longitudinal wave technique, and specimens whose failure initiated at defects detected by the shear wave technique showed significantly lower strength than those whose cause of failure was undefined. Investigation of inspection frequencies up to 75 MHz revealed the need for instrumentation and transducer performance improvements in order to achieve the potential for higher defect detection sensitivity. GRA

N78-11248# National Physical Lab., Teddington (England).
THERMAL STRESS AND THERMAL SHOCK IN CERAMICS. A SURVEY OF INDUSTRIAL PROBLEMS AND A REVIEW OF TEST METHODS AND THERMAL STRESS THEORY
R. Morrell Apr. 1977 99 p refs
(NPL-Chem-66) Avail: NTIS HC A05/MF A01

A number of representative manufacturers and users of dense ceramics were questioned on their problems associated with thermal stress or shock failure, the consequent losses, and test methods they have devised for the following material types: glass, technical ceramics, whiteware, and refractories. The survey has shown that although in principle the problems are understood, designing for their removal is difficult. The theory of thermal stress and thermal failure has been developed to a stage where a full analysis of a situation is possible; however, this can be done only for the homogeneous elastic continua upon which the thermal stress equations are based. Analytical forms cannot be generated for internal stress due to crystalline anisotropy, and finite element analysis is required in this case as well as for cases more complex than simple plates, tubes or spheres, or in cases of variable heat transfer coefficient. Tests on simple rod shapes have been shown to be valid as material comparisons only under the conditions of the test; however, if the materials are very well characterized in terms of fracture parameters, Weibull statistics, and temperature dependent thermal properties, and if it is possible to use one of the thermal shock resistance parameters to characterize them, then in principle it is possible to predict comparative performance under test conditions. Author (ESA)

N78-11249# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Manufacturing Research and Product Development Dept.
INVESTIGATION INTO THE INFLUENCE OF OUTDOOR WEATHERING ON THE MECHANICAL PROPERTIES OF CARBON FIBRE REINFORCED THERMOSETTING EPOXY RESIN
W. Nieland 10 Feb. 1976 10 p
(FOK-R-2094) Avail: NTIS HC A02/MF A01

Results of tests in CFRP panels inflection due to outdoor weathering and boiling in hot water are presented. The epoxy preimpregnated carbon fiber CFRP (TH 5696) processed in accordance with TH 6.5027 were shown to have relatively good resistance. Boiling in tap water for 2 hours seems to have more severe effects on flexural strength than 18 months of outdoor weathering. ESA

N78-11250# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Manufacturing Research and Product Development Dept.
TEST ON INFLAMMABILITY IN ACCORDANCE WITH FAR 25 AMENDMENT 32
L. M. DArnaud 29 Mar. 1977 4 p
(FOK-R-2131) Avail: NTIS HC A02/MF A01

The results of burning tests performed on MIKREX glass fiber reinforced polyester resin sheets are given. They show compliances with specification FAR 25 amendment 32. ESA

N78-11988# European Space Agency, Paris (France).
STUDY OF THE FLAMMABILITY OF HEAT RESISTING POLYMERS
C. Belinski and F. LalauKeraly *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-1 (ESA-TT-407) Sep. 1977 p 80-98 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-1, Jan.-Feb. 1977 p 39-47 Original report in FRENCH previously announced as A77-27743 (For availability see N78-11984 02-99)
Avail: NTIS HC A07/MF A01

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N78-11251# National Aviation Facilities Experimental Center, Atlantic City, N. J.
FULL-SCALE AIRCRAFT CRASH TESTS OF MODIFIED JET FUEL Final Report, Jul. 1972 - May 1974
Robert H. Ahlers Jul. 1977 98 p
(FAA Proj. 181-520-000)
(AD-A043843; FAA-NA-77-35; FAA-RD-77-13) Avail: NTIS HC A05/MF A01 CSCL 21/4

Crash tests were conducted with two A3 and two RB66 aircraft under impact-survivable crash conditions. The wing tanks in the first RB66 aircraft contained Jet A fuel modified with an 0.7-percent polymeric additive. The aircraft was crash tested into the specially constructed test site at 104.6 knots. The fuel mist generated by the fuel released from four crash-inflicted openings in the front wing spar was not ignited by the array of ignition sources. The wing tanks in the second RB66 aircraft were filled with JET A fuel modified with 0.5-percent of

the same polymeric additive. The aircraft was crashed into the test site at 102.4 knots. The test conditions for the second RB66 test were made more severe by increasing the fuel temperature, partially drilling out areas in the front spar to increase the opened fuel spillage area, and by adding four fuel release openings under the wing, larger ignition sources, and operating the engines. The fuel mist burst into flame and followed the aircraft down the test site, continuing to burn until extinguished by the firefighting crew. These full-scale tests indicate that modified fuels have a potential for reducing the postcrash fire hazard. Author

N78-11252*# Southwest Research Inst., San Antonio, Tex.
MEASUREMENTS OF BLAST WAVES FROM BURSTING FRANGIBLE SPHERES PRESSURIZED WITH FLASH-EVAPORATION VAPOR OR LIQUID Final Report
E. D. Esparaza and W. E. Baker Washington NASA Nov. 1977 46 p refs
(Grant NsG-3008)
(NASA-CR-2811; SwRI-02-4599) Avail: NTIS HC A03/MF A01 CSCL 19A

Incident overpressure data from frangible spheres pressurized with a flash-evaporating fluid in liquid and vapor form were obtained in laboratory experiments. Glass spheres under higher than ambient internal pressure of Freon-12 were purposely burst to obtain time histories of overpressure. Nondimensional peak pressures, arrival and duration times, and impulses are presented, and whenever possible plotted and compared with compiled data for Pentolite high-explosive. The data are generally quite repeatable and show differences from blast data produced by condensed high-explosives. Author

N78-11253# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
CORRECTIVE ACTION PROGRAM FOR BROMOCHLOROMETHANE-CONTAINING FIRE-SAFE DIESEL FUEL Final Report
W. D. Weatherford, Jr. and B. R. Wright Sep. 1976 80 p refs
(Contract DAAG53-76-C-0003)
(AD-A043323; AFLRL-81) Avail: NTIS HC A05/MF A01 CSCL 21/4

Following a laboratory-engine endurance test of bromochloromethane (BCM) 'fire-safe fuel' (FSF) in a 12-cylinder, air-cooled, four-cycle AVDS 1790-2C diesel engine conducted by Teledyne Continental Motors, a multifaceted experimental program was originated by MERADCOM/AFLRL (Mobility Equipment Research and Development Command/Army Fuels and Lubricants Research Laboratory) to establish whether or not 'fixes' could be developed to overcome the problems that caused the engine endurance test to be terminated after 150 rather than the intended 400 operating hours. Recapitulation of test events, detailed post-test examinations of engine parts and used lubricant samples, and follow-through experimental studies by MERADCOM/AFLRL confirmed or indicated plausible mechanisms for the observed difficulties. First, the fuel pump plunger rod sticking problem was confirmed to have been caused by corrosion at the fuel-oil interface; second, the fuel injector valve sticking was caused by a lacquer-like deposit; third, the fuel injector nozzle holes had become substantially enlarged and elongated by predominately corrosive mechanisms; fourth, excessive distress experienced by the oil-control piston ring appeared to have resulted from combined effects of stress corrosion cracking caused by HCl and scuffing caused by inadequate lubrication and fifth, oil filter plugging was found to have resulted from the formation of halon by-product and wear-metal-containing sludge in the lubricant. GRA

N78-11254# Federal Energy Administration, Washington, D. C. Strategic Petroleum Reserve Office.
STRATEGIC PETROLEUM RESERVE: SUPPLEMENT TO FINAL ENVIRONMENTAL IMPACT STATEMENT FOR BAYOU CHOCTAW SALT DOME
May 1977 180 p refs
(PB-270435/1; FEA/S-77/129-Suppl; FES-76-5-Suppl) Avail: NTIS HC A09/MF A01 CSCL 21D

A supplemental to a site specific final Environment Impact Statement prepared for the proposed storage of crude oil at the Bayou Choctaw salt dome located in Iberville Parish, Louisiana. The project is part of the Strategic Petroleum Reserve program, created for the purpose of providing the United States with sufficient petroleum reserves to minimize the effects of any oil supply interruption. The supplement considers the incremental effects on the environment which would result from constructing terminal facilities at St. James together with the pipeline which would connect St. James to the Bayou Choctaw storage site. GRA

N78-11255# Federal Energy Administration, Washington, D. C. Strategic Petroleum Reserve, Central Rock Mine
STRATEGIC PETROLEUM RESERVE: CENTRAL ROCK MINE Final Report
Jul. 1977 515 p refs
(PB-270447/6; FEA/S-77/214) Avail: NTIS HC A22/MF A01 CSCL 21D

An Environmental Impact Statement identifying particularly sensitive environmental parameters investigated in detail for the Central Rock, Kentucky early storage reserve site is presented. The most sensitive parameters to be affected by oil storage development at the site appear to be water quality, air quality, and socioeconomic factors. (GRA)

N78-11256# Federal Energy Administration, Washington, D. C. Strategic Petroleum Reserve Office.
STRATEGIC PETROLEUM RESERVE: BYRON MOUND SALT DOME, DRAFT SUPPLEMENT Final Report
Jul. 1977 383 p refs Supplement to Report to PB-262839
(PB-270108/4; FEA/S-77/211-Suppl) Avail: NTIS HC A17/MF A01 CSCL 21D

A draft supplement to the environmental impact statement for an underground crude oil storage facility at the Bryan Mound salt dome located in Brazoria County, Texas is presented. The storage facility at the Bryan Mound salt dome is part of the Strategic Petroleum Reserve program, created for the purpose of providing the United States with sufficient petroleum reserves to minimize the effects of any oil supply interruption. Author

N78-11987# European Space Agency, Paris (France).
SOLID PROPELLANTS FOR RAMJETS: AUTO-PYROLYZING FUELS
L. Nadaud, F. Reynaud, and A. Moutet *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-1 (ESA-TT-407) Sep. 1977 p 61-79 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977- 1, Jan.-Feb. 1977 p 31-38 Original report in FRENCH previously announced as A77-27742 (For availability see N78-11984 02-99)
Avail: NTIS HC A07/MF A01

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N78-11257 American Metric Council, Washington, D. C.
METRICATION FOR THE MANAGER
John T. Benedict Sep. 1977 53 p refs
(LC-77-84932; ISBN-0-916148-12-2) Copyright. Avail: Issuing Activity

Metric conversion was viewed as a major long term project affecting every department in a company. The concept favored in metrication called for various functions and areas of responsibility to prepare their own plans and conduct their own programs based on corporate policy, a metric product plan, and a set of guidelines. The intent was to begin with a product-oriented changeover to metric measurement and assimilate the change gradually, over a suitable period of time, in a manner that would be least costly and disruptive. Author

N78-11258# National Bureau of Standards, Washington, D. C.
THE INTERNATIONAL SYSTEM OF UNITS (SI)
Aug 1977 46 p refs Transl. into ENGLISH of the mono. "Le Systeme International d'Unites" Paris, OFFILIB, 1977
(NBS-SP-330) Avail: NTIS MF A01; SOD HC $1.60 as C13.10:330/4

The resolutions and recommendations of the General Conference on Weights and Measures (CGPM) on the International System of Units are published herein. Explanations have been added as well as relevant extracts from the International Standards of the International Organization for Standardization (ISO) for the practical use of the System. Appendix I reproduces in chronological order the decisions promulgated since 1889 by the CGPM and the International Committee for weights and measures (CIPM) on units of measurement and on the International System of Units. Appendix II outlines the measurements, consistent with the theoretical definitions given here, which metrological laboratories can make to realize the units and to calibrate precision material standards. This 3d edition is the second edition brought up to date with the decisions of the 15th CGPM (1975) and the amendments made by the CCU at its 4th and 5th sessions (1974 and 1976) and by the CIPM at its session of September 1976. Author

N78-11259# Federal Aviation Administration, Washington, D. C.
AN OVERVIEW OF FAA ACTIVITIES IN CIVIL AVIATION METRICATION Final Report
Carlo Yulo 1977 18 p refs
(AD-A043475; FAA-RD-77-95) Avail: NTIS HC A02/MF A01 CSCL 01/2

An overview of FAA involvement in civil aviation metrication activities is presented. The problems associated with conversion of the National Airspace System are summarized. A system analysis effort is proposed to obtain a better understanding of metric conversion impact and to forecast risk factor(s) in order not to compromise safety. An engineering and development program is outlined to serve as a stimulant to initiate or provoke further thinking in describing what needs to be done. Author

N78-11260*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LIQUID HYDROGEN FLASH VAPORIZER Patent Application
Albert M. Momenthy, inventor (to NASA) (Boeing Commercial Airplane Co., Seattle) Filed 21 Oct. 1977 9 p Sponsored by NASA
(NASA-Case-LAR-12159-1; US-Patent-Appl-SN-844347) Avail: NTIS HC A02/MF A01 CSCL 13I

A method and device are disclosed for initially reducing the temperature of a stream of LH2 in a fuel distribution line. The device allows some LH2 to escape into and vaporize in a shroud surrounding a length of the line just upstream of the nozzle. The effect of this controlled evaporation is to cool the LH2 in the line to satisfactorily low temperatures before it exits the line. This prevents the immediate vaporization of the fuel as it leaves the line. NASA

N78-11261# Bristol Univ. (England). Dept. of Mechanical Engineering.
THE DESIGN AND DEVELOPMENT OF AN ULTRASONIC IMMERSION TANK SYSTEM B.S. Thesis
C. S. Henshall and D. S. Hunt Jun. 1977 59 p
(BU-77/C.4) Avail: NTIS HC A04/MF A01

Initially investigations were made into the design features incorporated in commercially built immersion tank systems. The design was then considered in detail and a machine was built. The operation of the machine was examined and alterations were considered and carried out where possible. Author (ESA)

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N78-11262 Weapons Research Establishment, Salisbury (Australia).
ROCKET BORNE OBSERVATION OF ELECTRON DENSITY DURING A TRAVELLING IONOSPHERIC DISTURBANCE
K. H. Lloyd and C. J. Beach Jun. 1977 19 p refs
(WRE-TR-1828(W)) Avail: Issuing Activity

Measurements of the electron density profile made during a period of intense travelling ionospheric disturbance activity are presented. The electron density profile was determined using a swept frequency r.f. impedance probe, and compared with ionograms from an ionosonde located directly below the rocket trajectory. Author

N78-11263*# National Aeronautics and Space Administration, Washington, D. C.
ANALYSIS OF ECONOMICS OF A TV BROADCASTING SATELLITE FOR ADDITIONAL NATIONWIDE TV PROGRAMS Final Report
D. Becker, G. Mertens, A. Rappold, and W. Seith Jul. 1977 55 p refs Transl. into ENGLISH of West German reports BMFT-FB-T-76-5 and BMFT-NT-581, Jun. 1976 p 1-73 Original language document was announced as N77-11270 Transl. by Scientific Translation, Inc., Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75128; BMFT-FB-T-76-5; BMFT-NT-581) Avail: NTIS HC A04/MF A01 CSCL 05C

The influence of a TV broadcasting satellite, transmitting four additional TV networks was analyzed. It is assumed that the cost of the satellite systems will be financed by the cable TV system operators. The additional TV programs increase income by attracting additional subscribers. Two economic models were established: (1) each local network is regarded as an independent economic unit with individual fees (cost price model) and (2) all networks are part of one public cable TV company with uniform fees (uniform price model). Assumptions are made for penetration as a function of subscription rates. Main results of the study are: the installation of a TV broadcasting satellite improves the economics of CTV-networks in both models; the overall coverage achievable by the uniform price model is significantly higher than that achievable by the cost price model. Author

N78-11264*# Virginia Univ., Charlottesville. Dept. of Electrical Engineering.
OPTIMIZATION OF MLS RECEIVERS FOR MULTIPATH ENVIRONMENTS Annual Report
G. A. McAlpine, S. H. Irwin, Nelson, and Ghassem Roleyni Nov. 1977 250 p refs
(Grant NsG-1128)
(NASA-CR-155230; UVA/528062/EE77/104) Avail: NTIS HC A11/MF A01 CSCL 17B

Optimal design studies of MLS angle-receivers and a theoretical design-study of MLS DME-receivers are reported. The angle-receiver results include an integration of the scan data processor and tracking filter components of the optimal receiver into a unified structure. An extensive simulation study comparing the performance of the optimal and threshold receivers in a wide variety of representative dynamical interference environments was made. The optimal receiver was generally superior. A simulation of the performance of the threshold and delay-and-compare receivers in various signal environments was performed. An analysis of combined errors due to lateral reflections from vertical structures with small differential path delays, specular ground reflections with neglible differential path delays, and thermal noise in the receivers is provided. Author

N78-11265# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EFFECTS OF RF POWER DEVIATIONS ON BCAS LINK RELIABILITY
William Harman 7 Jun. 1977 33 p ref
(Contract DOT-FA75WAI-592)
(AD-A044312; ATC-76; FAA-RD-77-78) Avail: NTIS HC A03/MF A01 CSCL 01/2

In the design of a Beacon Collision Avoidance Systems (BCAS) there is some freedom in the choice of specifications for BCAS transmitter power and receiver Minimum Triggering Level (MTL). Transmitter power should be high enough to provide adequate link reliability while being low enough to prevent interference problems. The question of providing adequate link reliability for the Discrete A Beacon System (DABS) mode of BCAS is addressed in this study. The study makes use of aircraft antenna gain data resulting from a model measurement program, and, is other-

wise, analytical. It is concluded that appropriate nominal design values are transmitter power = 500 watts and receiver MTL = 77 dbm (referred to the BCAS unit). It is shown that these values provide sufficient power margin, at the air-to-air ranges appropriate for BCAS, so as to allow for adverse power deviations that might result from aircraft antenna gains, antenna cabling, and the expected transmitter and receiver deviations due to manufacturing nonuniformities and aging. Author

N78-11266*# National Aeronautics and Space Administration. Pasadena Office, Calif.
AZIMUTH CORRELATOR FOR REAL-TIME SYNTHETIC APERTURE RADAR IMAGE PROCESSING Patent Application
Wayne E. Arens, inventor (to NASA) (JPL) Filed 18 Oct. 1977 23 p
(Contract NAS7-100)
(NASA-Case-NPO-14019-1; US-Patent-Appl-SN-843308) Avail: NTIS HC A02/MF A01 CSCL 17I

An azimuth correlator architecture is defined. A number of serial range-line buffer memories are cascaded such that the output stages of all buffer memories together form a complete and unique range bin in the azimuthal dimension at any given time. A range bin is automatically read out of the last stages of the registers in parallel on a range line sample-by-sample basis for subsequent range migration correction and correlation. Range migration correction is performed on the range bins by effectively varying the length of a delay register at the output of each range line buffer memory. The corrected range bin output from the delay registers is then correlated with a Doppler reference function to form an image element on a real-time basis. NASA

N78-11267*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Electrical Engineering Dept.
A DEPOLARIZATION AND ATTENUATION EXPERIMENT USING THE CTS AND COMSTAR SATELLITES. MATHEMATICAL FORMULATIONS AND DEFINITIONS FOR DUAL POLARIZED RECEPTION OF A WAVE PASSING THROUGH A DEPOLARIZING MEDIUM (A POLARIZATION PRIMER)
W. L. Stutzman Jun. 1977 71 p refs
(Contract NAS5-22577)
(NASA-CR-156644; Suppl-1) Avail: NTIS HC A04/MF A01 CSCL 17B

The theoretical fundamentals and mathematical definitions for calculations involved with dual polarized radio links are given. Detailed derivations and results are discussed for several formulations applied to a general dual polarized radio link. Author

N78-11268*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
MOBILE MULTIPLE ACCESS STUDY Final Report
16 Aug. 1977 138 p refs
(Contract NAS5-23454)
(NASA-CR-156650) Avail: NTIS HC A07/MF A01 CSCL 17B

Multiple access techniques (FDMA, CDMA, TDMA) for the mobile user and attempts to identify the current best technique are discussed. Traffic loading is considered as well as voice and data modulation and spacecraft and system design. Emphasis is placed on developing mobile terminal cost estimates for the selected design. In addition, design examples are presented for the alternative techniques of multiple access in order to compare with the selected technique. Author

N78-11269# European Space Agency, Paris (France).
DIRECT SATELLITE BROADCASTING
Aug. 1977 173 p refs Partly in ENGLISH and partly in FRENCH Proc. of an ESA/European Broadcasting Union Symp., Dublin, 23-25 May 1977
Avail: NTIS HC A08/MF A01

Papers are presented in the field of direct satellite broadcasting programs for Europe. The topics covered include: technical possibilities of direct broadcast satellites; experiments under way and future projects; economic comparison with terrestrial systems; individual and community reception; technically unavoidable spillover; and legal problems. For individual titles, see N78-11270 through N78-11280.

N78-11270# European Space Agency, Paris (France).
DIRECT TELEVISION SATELLITES: PROSPECTS AND PROBLEMS
A. Lebeau *In its* Direct Satellite Broadcasting Aug. 1977 p 15-24 In ENGLISH and FRENCH (For availability see N78-11269 02-32)
Avail: NTIS HC A08/MF A01

A general description is given of the direct broadcasting TV satellite and the technology required for signal reception. Problems related to the introduction of these satellites are outlined; they are mainly legal and economic. Future prospects such as the use of space transportation systems for launch and maintenance and the use of higher frequencies are discussed. ESA

N78-11271# European Broadcasting Union, Brussels (Belgium).
BROADCASTERS' VIEWPOINTS ON THE SUBJECT. RESULTS OF THE ITU PLANNING CONFERENCE AND ITS CONSEQUENCES
R. Gressmann *In* ESA Direct Satellite Broadcasting Aug. 1977 p 25-35 refs In ENGLISH and FRENCH (For availability see N78-11269 02-32)
Avail: NTIS HC A08/MF A01

The views and requirements of broadcasting organisations regarding direct TV broadcasting satellites are outlined, and results of the Geneva planning conference are discussed. The Geneva plan is based on individual reception and on national coverage. Beams provided for are shaped so that their cross section is elliptical or circular. A total of 907 assignments to 247 service areas has been considered. The consequences of the plan for European coverage on a national basis are described, noting spillover and interference effects. ESA

N78-11272# European Space Agency, Paris (France).
CURRENT EXPERIMENTS AND FUTURE PROJECTS AND THEIR POSSIBLE IMPLICATIONS FOR WESTERN EUROPE. GENERAL PICTURE
Anne-Marie Hieronimus *In its* Direct Satellite Broadcasting Aug. 1977 p 37-48 In ENGLISH and FRENCH (For availability see N78-11269 02-32)
Avail: NTIS HC A08/MF A01

The contributions made to direct satellite TV broadcasting by the ATS-6 and CTS satellites are examined both from the point of view of space technology and from that of the utilization of television. Benefits derived from these projects for the European satellite and for operational satellite projects are outlined. ESA

N78-11273# European Space Agency, Paris (France).
THE PROPOSED EUROPEAN PRE-OPERATIONAL SATELLITE BROADCASTING EXPERIMENTAL PROGRAMME
B. L. Herdan *In its* Direct Satellite Broadcasting Aug. 1977 p 49-66 refs In ENGLISH and FRENCH (For availability see N78-11269 02-32)
Avail: NTIS HC A08/MF A01

The communications system design, space segment design and development/planning program, and potential experimental and pre-operational utilization program are dealt with. The relevance of the proposed program to the transition to future operational systems, both in terms of the communications system design and the development of the appropriate satellite hardware is summarized. ESA

N78-11274# Norsk Rikskringkasting, Oslo (Norway).
POSSIBLE USE OF AN EXPERIMENTAL AND PRE-OPERATIONAL SATELLITE BY EUROPEAN BROADCASTERS
Hans J. Birkrem *In* ESA Direct Satellite Broadcasting Aug. 1977 p 69-72 In ENGLISH and FRENCH (For availability see N78-11269 02-32)
Avail: NTIS HC A08/MF A01

The role of the proposed Ariane L04 direct broadcasting satellite in the program planning of broadcasting organizations in the Nordic countries is outlined. ESA

N78-11275 Radiotelevisione Italiana, Turin (Italy).
ECONOMICAL SURVEY OF BROADCASTING SATELLITE AND COMPARISON WITH TERRESTRIAL TELEVISION SYSTEMS
Carlo Terzani *In* ESA Direct Satellite Broadcasting Aug. 1977

p 73-80 In ENGLISH and FRENCH (For availability see N78-11269 02-32)
Avail: NTIS HC A08/MF A01

A cost evaluation of a broadcasting satellite service is presented, and a rough comparison is made with the costs of terrestrial television systems. The terrestrial systems of Italy, Norway, and the U.K. are considered. Future developments are outlined. ESA

N78-11276 European Space Agency, Paris (France).
INDIVIDUAL AND COLLECTIVE RECEPTION
R. C. Collette and H. H. Fromm *In its* Direct Satellite Broadcasting Aug. 1977 p 81-86 refs (For availability see N78-11269 02-32)
Avail: NTIS HC A08/MF A01

Present VHF/UHF TV broadcasting is compared with future satellite TV broadcasting. The additional receiving equipment is described. An examination of state-of-the-art technologies leads to the conclusion that high performance receivers can be manufactured at reasonable prices, the main investment being necessary for preparation of large quantity production methods. ESA

N78-11277 European Space Agency, Paris (France).
STATUS OF RECEIVE EQUIPMENT DEVELOPMENT
T. F. Howell *In its* Direct Satellite Broadcasting Aug. 1977 p 87-93 In ENGLISH and FRENCH (For availability see N78-11269 02-32)
Avail: NTIS HC A08/MF A01

The requirements and characteristics of the antenna and additional electronics needed for domestic reception of direct satellite broadcasts are outlined. A converter is required for reception of satellite transmissions using normal television or FM radio sets. ESA

N78-11278# European Broadcasting Union, Brussels (Belgium).
TECHNICALLY UNAVOIDABLE SPILLOVER (TECHNICAL ASPECTS AND INTERNATIONAL LAW ASPECTS)
Jean Autin *In* ESA Direct Satellite Broadcasting Aug. 1977 p 95-115 In ENGLISH and FRENCH (For availability see N78-11269 02-32)
Avail: NTIS HC A08/MF A01

Technical and legal aspects of technically unavoidable border-crossing spillover in direct satellite broadcasting are considered. Possible actions at the technical and legal level are summarized. ESA

N78-11279# European Broadcasting Union, Brussels (Belgium).
THE PROBLEMS OF PRIVATE LAW RAISED BY DIRECT BROADCASTING SATELLITES
Albert Scharf *In* ESA Direct Satellite Broadcasting Aug. 1977 p 117-126 In ENGLISH and FRENCH (For availability see N78-11269 02-32)
Avail: NTIS HC A08/MF A01

A summary is presented of the main problems having a specific bearing on the broadcasting satellite's antennas and related to copyright and contractual law on an international level. ESA

N78-11280# European Space Agency, Paris (France).
TECHNICAL AND ECONOMIC POSSIBILITIES OPEN TO SOUND BROADCASTING IN THE SATELLITE AGE
C. Rosetti *In its* Direct Satellite Broadcasting Aug. 1977 p 127-132 In ENGLISH and FRENCH (For availability see N78-11269 02-32)
Avail: NTIS HC A08/MF A01

The application of direct satellite broadcasting to UHF sound transmission is discussed. The advantages of such a system include the following: better coverage and an equal spread of the radio field over the whole service area; a transmitting segment much less costly than the equivalent terrestrial system; reception without interference or atmospherics; significant improvement in the efficiency of frequency spectrum utilization; possibility of making available to portable receivers and vehicle radios a number of programs with sound of higher quality than presently broadcast on the long and medium waves. ESA

N78-11281# Raytheon Co., Bedford, Mass. Missile Systems Div.
INSTALLATION DATA FOR GROUND MOVING TARGETS (GMTI/-7) AND RETRANSMISSION GUIDANCE Final Report, 18 Jun. - 10 Nov. 1976
H. F. Weissenburger May 1977 14 p refs
(Contract F33615-76-C-1331)
(AD-A043040; BR-9540; AFAL-TR-77-49) Avail: NTIS HC A02/MF A01 CSCL 17/9

Documents the requirements for the design and analysis of, and the acceptance of Class II modification data and hazard analysis report for installation of Low Cost Attack Radar modified to gather ground moving target data in an AC-130H aircraft. Author (GRA)

N78-11282# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
THE ESTIMATION OF DELAY GRADIENTS FOR PURPOSES OF ROUTING IN DATA COMMUNICATION NETWORKS M.S. Thesis
Martin Glen Bello Feb. 1977 193 p refs
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A043248; ESL-R-755) Avail: NTIS HC A09/MF A01 CSCL 17/2

Appealing to current and past work on the routing problem in data - communication networks, we motivate the need for algorithms that estimate the derivative with respect to flow, of the total message delay on each of the links. We then cast the problem in a queueing theory framework and, making no statistical assumptions other than stationarity, we propose three algorithms that process the record of arrivals and departures of a single-sever queue to derive an estimate of the derivative, with respect to arrival rate, of the total delay accumulated per unit time. Through simulation and analysis we show that all three algorithms are asymptotically unbiased and efficient for M/D/1 queues. By simulation of other queues we investigate the relative robustness of the three procedures. Finally, through examination of the storage and computational requirements we identify a single most promising algorithm Author (GRA)

N78-11283# RCA Government Systems Div., Burlington, Mass. Missile and Space Radar.
PROGRAMMABLE FFT LINEAR FM WAVEFORM PROCESSOR, PHASES 2 AND 3 Final Report, Feb. 1974 - Nov. 1976
LLoyd W. Martinson and John A. Lunsford Wright-Patterson AFB, Ohio AFAL Jul. 1977 224 p refs
(Contract F33615-74-C-1077)
(AD-A043302; AFAL-TR-77-33) Avail: NTIS HC A10/MF A01 CSCL 17/9

The PWP program, Programmable Fast Fourier Transform Linear FM Waveform Processor, features three principal developments: the step transform processing algorithm, floating point FFT processing and CMOS/SOS LSI technology. The step transform algorithm was studied and its realizability demonstrated under a pulse compression techniques study program (1) (F33615-72-C-1634). It features a sub-aperture processing technique for the digital pulse compression and expansion of linear FM waveforms. The algorithm was extended to sub-array processing of synthetic aperture radar (SAR) in Phase I of the PWP development program (2) (F33615-73-C-1275). Both SAR azimuth focusing and linear FM pulse compression can be processed with the same hardware configuration. The objective of the hardware development effort was to construct a programmable pulse compression/expansion system for use in advanced linear FM radar and synthetic aperture processing applications. GRA

N78-11284# California Univ., Berkeley. Dept. of Electrical Engineering and Computer Sciences.
RESEARCH IN INTEGRATED, HIGH-FREQUENCY COMMUNICATION CIRCUITS Final Report, 1 May 1974 - 30 Apr. 1977
R. G. Meyer and D. O. Pederson Jul. 1977 9 p refs
(Contract DAHC04-74-G-0151)
(AD-A043560; ARO-12131.6-EL) Avail: NTIS HC A02/MF A01

This report summarizes our research results in Integrated,

High-Frequency Communication Circuits. A monolithic integrated circuit process giving 1.7 GHz transistors has been realized. This allowed realization of an optimum, wideband, low-distortion, monolithic amplifier with 20 dB gain and 370 MHz bandwidth. The circuit incorporates low-noise Zener diodes and has a worst case noise figure of 9 dB. Research on monolithic VCOs yielded an optimum topology for a temperature-stable high-frequency VCO. A monolithic triangle sine wave converter yielding 0.3% total harmonic distortion over a 70 deg C temperature range has been realized for use with such VCOs. A computer-aided design program SINC-S has been written for the analysis of oscillator circuits. This typically gives a factor of three improvement in computation time compared with conventional techniques.
Author (GRA)

N78-11285# California Univ., Los Angeles. Dept. of System Science.
LIKELIHOOD RATIOS FOR SIGNALS IN ADDITIVE WHITE NOISE
A. V. Balakrishnan Jun. 1977 17 p refs
(Grant AF-AFOSR-2492-73)
(AD-A043850; AFOSR-77-1150TR) Avail: NTIS HC A02/MF A01 CSCL 17/2

A formula is presented for likelihood functionals for signals in which the corrupting noise is modelled as white noise rather than the usual Wiener process. The main difference is the appearance of an additional term corresponding to the conditional mean square error. One application is to consider the order-disorder problem of Shiryayev.
GRA

N78-11286# Army Command and General Staff Coll., Fort Leavenworth, Kansas.
LOW FREQUENCY RADAR SYSTEMS SHOULD REPLACE CURRENT HIGH FREQUENCY RADAR SYSTEMS ON THE BATTLEFIELD TO OPTIMIZE THE ARMYS GROUND SURVEILLANCE RADAR CAPABILITY M.S. Thesis. Final Report
Paul H. M. LaBay, III 10 Jun. 1977 106 p refs
(AD-A043739) Avail: NTIS HC A06/MF A01 CSCL 17/9

Current state-of-the-art technology provides the Army with two distinct types of radar to accomplish the ground surveillance mission. The first is a high frequency, line-of-sight system; the second is a low frequency, foliage independent system. To optimize its future ground surveillance radar capability, the Army must, in light of monetary and manpower constraints, choose that system which best fulfills its needs. This paper investigates the efficacy of both systems to detect, acquire, and identify targets of military interest on the battlefield. It addresses both the machine and man-machine/human aspects of radar operation. The demonstrated capabilities of both systems are compared and evaluated to determine which system shows the greatest potential to optimize the Army's ground surveillance radar capability. The study concludes that low frequency radar systems are superior to currently fielded high frequency radar systems. It further recommends that the Army place priority effort into developing low frequency radar systems for future ground use.
Author (GRA)

N78-11287# California Univ., Berkeley. Electronics Research Lab.
SCATTERING OF ELECTROMAGNETIC WAVES BY BURIED DIELECTRIC BODIES Final Report, 1 Aug. 1974 - 30 Sep. 1977
K. K. Mei, M. E. Morgan, and S. K. Chang Jun. 1977 55 p refs
(Contract DAAK02-75-C-0002; Grant DAAG29-77-G-0021)
(AD-A043806) Avail: NTIS HC A04/MF A01 CSCL 20/14

Recent development in the unimoment method has brought finite difference and finite element methods into the computational techniques of electromagnetic scattering. In this paper the various finite methods and their potentials in the scattering computations are examined. A section on programming technique is included for those uninitiated and the applications of the finite methods in 2-dimensional and 3-dimensional scattering problems, together with some of the associated computational subject matters are presented.
Author (GRA)

N78-11288# Stanford Research Inst., Menlo Park, Calif.
VLF/LF PROPAGATION BENEATH IRREGULARLY PERTURBED IONOSPHERES Final Report, 29 Mar. - 30 Nov. 1976
Gary H. Price and V. Elaine Hatfield Jan. 1977 48 p refs
(Contract DNA001-76-C-0252)
(AD-A043501; DNA-4250F) Avail: NTIS HC A03/MF A01 CSCL 20/14

The disturbance to very-low-frequency and low-frequency propagation produced by numbers of large-yield, low-altitude nuclear detonations is considered. The consequent lower-ionospheric irregularity both reduces the coherent reflection and produces an incoherently scattered component of the signal. These effects are found to be appreciable at detonation densities in the range of those considered in conjunction with large-scale attack scenarios.
Author (GRA)

N78-11289# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
TELEVISION MONITOR WITH ELECTRONIC ZOOM AND IMAGE POSITION CONTROL
Adolf R. Marko, David A. Ratino, and Don McCollor (Raytheon Service Co.) Jun. 1977 11 p
(AD-A043689; AMRL-TR-76-108) Avail: NTIS HC A02/MF A01 CSCL 17/2

For simulators and other research applications a television display with variable image size and image position capability is often required. Television monitors featuring this capability, in addition to variable scan rate and high degree of linearity, have been developed by industry, but are too expensive for many applications. This report describes a relatively inexpensive modification of a commercially available television monitor for electronic remote control of scan size and image position.
Author (GRA)

N78-11290# Institute for Telecommunication Sciences, Boulder, Colo.
EXTENDED AREA TEST SYSTEM IN THE 136-148 MHz BAND: AN EMC ASSESSMENT
E. J. Haakinson, A. C. Stewart, J. E. Adams, and L. E. Volger May 1977 223 p Sponsored in part by Pacific Missile Test Center, Point Mugy, Calif.
(PB-269226/7; OTR-77-122) Avail: NTIS HC A10/MF A01 CSCL 14B

The compatibility of an extended area test system (EATS) in the 136 to 148 MHz band was analyzed. Regulations affecting EATS operation are discussed and histograms of characteristics of current band occupants are given. These histograms show that 79% of the current frequency assignments in the 136 to 148 MHz band use frequency modulation and are used for voice communications. Laboratory measurements of tests between the EATS transmitter and several FM receivers also are discussed. Several computer simulation models were used to assess the compatibility of the EATS with the present band occupants.
GRA

N78-11291# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.
METAL SPACE FRAME RADOME ATTENUATION AT 11.4 GHz
Olavi Koistinen, Haakan Sandell, and Seppo Urpo 1976 10 p refs
(Rept-S-91; ISBN-951-750-798-4) Avail: NTIS HC A02/MF A01

A 13.7 m radio telescope with a metal space frame was used to determine the supplementary attenuation caused by radome during rain and snowfall. Measurements were made at 11.4 GHz, and the measured attenuation (in dB) can be expressed by the formula kR to the alpha power, where k = 1.7, alpha = 0.281, and R is the precipitation rate in mm/h. Wet snow on the radome can cause high attenuation reaching 5...6 dB. The accumulated dirt on the radome increases the rain attenuation values and recovery times.
Author (ESA)

N78-11292# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.
MICROWAVE EMISSION FROM SEA ICE
Surendra K. Parashar 1976 19 p refs

(Rept-S-90; ISBN-951-750-797-6) Avail: NTIS HC A02/MF A01

The available literature on microwave emission from sea ice is reviewed. Sections are included on the formation of sea ice and its relevant characteristics, radiometry theory, and theory of emission. Some of the past radiometric measurements of sea ice are given. In addition, different methods which can be used to analyze the radiometric data are presented. Author (ESA)

N78-11293# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.

DIELECTRIC PROPERTIES OF SEA ICE AT MICROWAVE FREQUENCIES

Martti Hallikainen 1977 55 p refs

(Rept-S-94; ISBN-951-750-960-X) Avail: NTIS HC A04/MF A01

The dielectric properties of fresh water ice at microwave frequencies are reviewed. The properties of brine liquid were approximated by those of aqueous NaCl solutions. Various models for the shape and geometrical arrangement of brine pockets were used to obtain the dielectric properties of the mixture as a function of frequency, temperature, and salinity. The method can be applied at microwave frequencies when the length of brine inclusions is much smaller than the wavelength. The equations used for obtaining the properties of liquid brine are valid only at temperatures close to the freezing point of sea water. In Finland the temperature of ice is generally higher than -5 C so that the temperature range of calculations is adequate in most cases. The temperature dependence of the theoretical results agrees fairly well with the experimental values reported in literature. The model which assumes that brine pockets are elongated ellipsoids the orientation of which is random gives results that best agree with measurements. Author (ESA)

N78-11294# National Bureau of Standards, Washington, D. C. Law Enforcement Standards Lab.

DIGITAL DATA TRANSMISSION TESTS ON VOICE CHANNELS

John Furze Jul. 1977 64 p refs Prepared by Urban Sciences, Inc., Wellesley, Mass. Sponsored by Dept. of Justice

(PB-270280/1; NBS-SP-480-19; LC-77-600023) Avail: NTIS HC A04/MF A01 CSCL 17B

In order to better understand the ramifications of transmitting and receiving digital data over typical channels, a series of tests were performed in Allegheny county, Pennsylvania, using existing local government transmitting sites and a specially equipped mobile unit and the time of day were varied for test purposes. Tests were conducted in both urban and suburban environments. Test procedures, sites routes, test equipment and the results obtained are discussed. GRA

N78-11139*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.

NEAR SUN RANGING

A. I. Zygielbaum *In its* The Deep Space Network 15 Oct. 1977 p 43-50 refs (For availability see N78-11132 02-12)

Avail: NTIS HC A11/MF A01 CSCL 20N

N78-11141*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Tracking Systems and Applications Section.

A TECHNIQUE TO DETERMINE UPLINK RANGE CALIBRATION DUE TO CHARGED PARTICLES

S. C. Wu and F. B. Winn *In its* The Deep Space Network 15 Oct. 1977 p 57-81 refs (For availability see N78-11132 02-12)

Avail: NTIS HC A11/MF A01 CSCL 17B

N78-11142*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.

DOPPLER PROFILES OF RADIO FREQUENCY INTERFERENCE

B. K. Levitt *In its* The Deep Space Network 15 Oct. 1977 p 82-85 refs (For availability see N78-11132 02-12)

Avail: NTIS HC A11/MF A01 CSCL 17B

N78-11147*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. TDA Engineering Office.

THE CTA 21 RADIO SCIENCE SUBSYSTEM: NON REAL-TIME BANDWITH REDUCTION OF WIDEBAND RADIO SCIENCE DATA

A. L. Berman and J. I. Molinder *In its* The Deep Space Network 15 Oct. 1977 p 127-134 ref (For availability see N78-11132 02-12)

Avail: NTIS HC A11/MF A01 CSCL 17B

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N78-11295*# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.

STUDY OF 42 AND 85 GHz COUPLED CAVITY TRAVELING-WAVE TUBES FOR SPACE USE

J. B. Kennedy, I. Tammaru, and P. S. Wolcott Jun. 1977 171 p refs

(Contract NAS3-19701)

(NASA-CR-134670; W-06553) Avail: NTIS HC A08/MF A01 CSCL 09A

Designs were formulated for four CW, millimeter wavelength traveling-wave tubes having high efficiency and long life. Three of these tubes, in the 42 to 44 GHz frequency region, develop power outputs of 100 to 300 watts with overall efficiencies of typically 45 percent. Another tube, which covers the frequency range of 84 to 86 GHz, provides a power output of 200 watts at 25 percent efficiency. The cathode current density in each design was 1A/sq cm. Each tube includes: metal-ceramic construction, periodic permanent magnet focusing, a two step velocity taper, an electron beam refocusing section, and a radiation cooled three-stage depressed collector. The electrical and mechanical design for each tube type is discussed in detail. The results of thermal and mechanical analyses are presented.

Author

N78-11296*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

COMPARISON OF EXPERIMENTAL AND THEORETICAL REACTION RAIL CURRENTS, RAIL VOLTAGES, AND AIRGAP FIELDS FOR THE LINEAR INDUCTION MOTOR RESEARCH VEHICLE Final Report, Jan. - Dec. 1976

David G. Elliott Jul. 1977 73 p refs Sponsored in part by Federal Railroad Administration

(Contract NAS7-100)

(NASA-CR-154528; JPL-77-36; FRA/ORD-77-33) Avail: NTIS HC A04/MF A01 CSCL 09C

Measurements of reaction rail currents, reaction rail voltages, and airgap magnetic fields in tests of the Linear Induction Motor Research Vehicle (LIMRV) were compared with theoretical calculations from the mesh/matrix theory. It was found that the rail currents and magnetic fields predicted by the theory are within 20 percent of the measured currents and fields at most motor locations in most of the runs, but differ by as much as a factor of two in some cases. The most consistent difference is a higher experimental than theoretical magnetic field near the entrance of the motor and a lower experimental than theoretical magnetic field near the exit. The observed differences between the theoretical and experimental magnetic fields and currents do not account for the differences of as much as 26 percent between the theoretical and experimental thrusts. Author

N78-11297*# DCA Reliability Labs., Sunnyvale, Calif. Special Products Lab.

JAN TRANSISTOR AND DIODE CHARACTERIZATION TEST PROGRAM Final Report

Hiro Takeda Mar. 1977 15 p

(Contract NAS8-31944)

(NASA-CR-150463) Avail: NTIS HC A02/MF A01 CSCL 09A

A statistical summary of electrical characterization was performed on JAN diodes and transistors. Parameters are

presented with test conditions, mean, standard deviation, lowest reading, 10% point, 90% point and highest reading. Author

N78-11298*# DCA Reliability Labs., Sunnyvale, Calif. Special Products Div.
JAN TRANSISTOR AND DIODE CHARACTERIZATION TEST PROGRAM, JANTX DIODE 1N5619 Final Report
Hiro Takeda Feb. 1977 15 p
(Contract NAS8-31944)
(NASA-CR-150462) Avail: NTIS HC A02/MF A01 CSCL 09C

A statistical summary of electrical characterization was performed on JANTX 1N5619 silicon diodes. Parameters are presented with test conditions, mean, standard deviation, lowest reading, 10% point, 90% point, and highest reading. Author

N78-11299*# DCA Reliability Labs., Sunnyvale, Calif. Special Products Div.
JAN TRANSISTOR AND DIODE CHARACTERIZATION TEST PROGRAM, JANTX DIODE 1N5623 Final Report
Hiro Takeda Feb. 1977 16 p
(Contract NAS8-31944)
(NASA-CR-150464) Avail: NTIS HC A02/MF A01 CSCL 09A

A statistical summary of the electrical characterization of diodes and transistors is presented. Each parameter is presented with test conditions, mean, standard deviation, lowest reading, 10% point (where 10% of all readings are equal to or less than the indicated reading), 90% point (where 90% of all readings are equal to or less than indicated reading) and the highest reading. Author

N78-11300*# DCA Reliability Labs., Sunnyvale, Calif. Special Products Div.
JAN TRANSISTOR AND DIODE CHARACTERIZATION TEST PROGRAM, JANTX DIODE 1N649-1 Final Report
Hiro Takeda Feb. 1977 17 p
(Contract NAS8-31944)
(NASA-CR-150461) Avail: NTIS HC A02/MF A01 CSCL 09A

The data processing and calculation of statistical parameters were performed by the Tektronix computer system. The data acquired for easy vendor to vendor and date code to date code analysis are summarized. Each parameter is presented with test conditions, mean, standard deviation, lowest reading, 10% point (where 10% of all readings are equal to or less than the indicated reading), 90% point (where 90% of all readings are equal to or less than the indicated reading) and the highest reading. Author

N78-11301*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INSTRUMENT TO AVERAGE 100 DATA SETS
George B. Tuma, Arthur G. Birchenough, and William J. Rice Oct. 1977 19 p
(NASA-TP-1055; E-9159) Avail: NTIS HC A02/MF A01 CSCL 09C

An instrumentation system is currently under development which will measure many of the important parameters associated with the operation of an internal combustion engine. Some of these parameters include mass-fraction burn rate, ignition energy, and the indicated mean effective pressure. One of the characteristics of an internal combustion engine is the cycle-to-cycle variation of these parameters. A curve-averaging instrument has been produced which will generate the average curve, over 100 cycles, of any engine parameter. the average curve is described by 2048 discrete points which are displayed on an oscilloscope screen to facilitate recording and is available in real time. Input can be any parameter which is expressed as a + or - 10-volt signal. Operation of the curve-averaging instrument is defined between 100 and 6000 rpm. Provisions have also been made for averaging as many as four parameters simultaneously, with a subsequent decrease in resolution. This provides the means to correlate and perhaps interrelate the phenomena occurring in an internal combustion engine. This instrument has been used successfully on a 1975 Chevrolet V8 engine, and on a Continental 6-cylinder aircraft engine. While this instrument was designed for use on an internal combustion engine, with some modification it can be used to average any cyclically varying waveform. Author

N78-11302# Naval Surface Weapons Center, White Oak, Md.
HIGH POWER SPARK GAP SWITCH PROGRAM
J. P. Heckl, W. Clark, and J. Driscoll 1976 9 p refs
(AD-A042675) Avail: NTIS HC A02/MF A01 CSCL 09/1

A program is presently underway into the investigation and final development of a spark gap switch capable of operating at repetition rates of 50 to 250 pulses/sec (pps) at voltages of several hundred kilovolts and 5 megawatts average power. Results of an Aero Propulsion Laboratory program on High Power Spark Gap Switch Development led to the present study, which is a coordinated effort between the Gas Dynamics Laboratories of the University of Michigan, Naval Surface Weapons Center and Maxwell Laboratories, Inc. Theoretical investigations into the nature of dynamic nonstationary arcs under transverse gas flow conditions between electrodes are discussed. Future plans for experimental studies of arc properties include time resolved temperature measurements using a unique optical scanning system at the University of Michigan. An optimized high power spark gap switch will be designed and fabricated by Maxwell Laboratories and tested at their switch test facility. Author (GRA)

N78-11303# Naval Surface Weapons Center, White Oak, Md.
THE LIQUID METAL PLASMA VALVE CLOSING SWITCH
John R. Bayless and Joseph P. Heckl 1976 7 p refs
(AD-A042676) Avail: NTIS HC A02/MF A01 CSCL 09/5

The liquid metal plasma valve (LMPV) is a high average power mercury vacuum-arc switching device. It has been extensively developed over the past ten years as a converter valve for use by the electric utilities industry at nominal average power levels of 90 MW. This paper will describe an LMPV closing switch now under development for operation in conjunction with a PFN to deliver 1 MW average power to a load in 20 to 50 microsec. pulses at up to 100 kV. The objective of this development is to obtain information for the design of switches capable of operating at much higher power levels. Author (GRA)

N78-11304# Naval Postgraduate School, Monterey, Calif.
A COMPUTER AIDED DESIGN OF DIGITAL FILTERS
Salih Kayhan Elitas Jun. 1977 106 p refs
(AD-A042288) Avail: NTIS MF A01 CSCL 09/5

Expressions for a generalized Modified Transitional Butterworth-Chebyshev (MTBC) filter are derived. The characteristics of this filter as applied to digital filter design are investigated. It is shown that by adjusting location and order of the inserted zeros, the cut-off slope rate of the filter can be traded for maximum attenuation in the stop band. The performance of this MTBC filter is compared to that of Butterworth, Chebyshev, transitional Butterworth-Chebyshev filters together with those suggested by other investigators. It is shown that the stop-band attenuation can be significantly increased without great sacrifice of cut-off slope rate. Step response of this MTBC filter is also obtained and compared with other filters. Various tabulations as well as graphs of this filter are given for design purposes. A computer program is developed for the design of this filter. Author (GRA)

N78-11305# Harry Diamond Labs., Adelphi, Md.
THE EXPERIMENTAL DETERMINATION OF THE ELECTRIC FIELDS SURROUNDING A MODEL AIRCRAFT
Neil D. Wilkin Jul. 1977 55 p refs
(DA Proj. 1W3-62616-AH-77)
(AD-A043257; HDL-TM-77-5) Avail: NTIS HC A04/MF A01 CSCL 20/3

All aircraft collects electrostatic charges during flight, and use of the resultant electric fields has been proposed to initiate fuzing of antiaircraft projectiles. Plots of the resultant fields close to full-scale aircraft are difficult to obtain. An electrolytic tank may be used to measure these fields by using scaled models. Plots were made of the equipotential surfaces about an F4-J scaled aircraft and of potential differences (measure of potential gradient) between probes on prescribed trajectories past the scaled model. These data are presented in this report and can be used to estimate fuzing performance. Author (GRA)

N78-11306# Illinois Univ., Urbana-Champaign. Electromagnetics Lab.

SIMPLE APPROXIMATE FORMULA FOR MUTUAL ADMITTANCE BETWEEN SLOTS ON A CYLINDER
S. W. Lee and S. Safavi-Naini Jul. 1977 39 p refs
(Contract N00019-77-C-0127)
(AD-A043249; UIEM-77-13; UILU-ENG-77-2555) Avail: NTIS HC A03/MF A01 CSCL 20/3

Based on a newly developed asymptotic Green's function for a magnetic dipole on a conducting surface (1), this paper presents a simple, closed-form formula for the mutual admittance between two slots on a cylinder or a plane. When compared with the exact solution obtained by numerical integrations, this formula gives accurate results when the slots are relatively small and their separation large. Author (GRA)

N78-11307# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE AMPLITUDE EFFECT OF POINT-SOURCE BLOOMING AS A FUNCTION OF BACKGROUND LEVEL IN EBSICON-TYPE CAMERA TUBES
Robert Weber 16 Jun. 1977 13 p refs
(Contract F19628-76-C-0002; AF Proj. 2128)
(AD-A043277; TN-1977-31; ESD-TR-77-120) Avail: NTIS HC A02/MF A01 CSCL 09/1

A laboratory experiment is described in which the amplitude effect of point-source blooming in an ebsicon-type (i.e., intensified silicon-diode array) camera tube is demonstrated as a function of uniform background level. At very low background levels, the signal required for constant video signal-to-noise ratio, as measured on an A-scope, is approximately constant; at intermediate levels, it varies approximately as the one-half power of the background level; and, at high background levels, the power law exceeds unity. An amplitude-degradation function, f, obtained from the measurements, is presented. The importance of the f-function in point-source measurements using an A-scope is discussed. Author (GRA)

N78-11308# Air Force Weapons Lab., Kirtland AFB, N. Mex.
SELF-CONDITIONING TRANSDUCERS Final Report
David J. Ray Aug. 1977 8 p refs Repr. from Instrum. Technol., Sep. 1976 p 69-73
(AD-A043710; AFWL-TR-77-504) Avail: NTIS HC A02/MF A01 CSCL 17/2

When strain gage signals placed directly on long data lines are received by remote processing systems, they may be so attenuated, distorted and superimposed with noise that they no longer represent the parameter being measured. The author describes two types of signal conditioners which can be placed at the point of measurement to overcome these problems, and includes the advantages and limitations of each device.
Author (GRA)

N78-11309# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
MNOS BORAM MANUFACTURING METHODS AND TECHNOLOGY PROJECT Quarterly Progress Report, 1 Jan. - 31 Mar. 1977
Joe E. Brewer, T. G. ODonnell, Philip C. Smith, and L. A. Epstein Mar. 1977 52 p refs
(Contract DAAB07-76-C-0048)
(AD-A043316; Rept-77-0422; QPR-3) Avail: NTIS HC A04/MF A01 CSCL 09/5

A manufacturing methods project has been initiated to establish a pilot production line for metal nitride oxide semiconductors (MNOS) block oriented random access memory (BORAM) multichip hybrid circuits. During the past quarter the first set of engineering samples were delivered, and fabrication of the second set was initiated. Further experience was gained with a new low cost MNOS BORAM die. Hybrid circuit and memory card development progressed. In addition, transistor endurance testing concepts were explored. Author (GRA)

N78-11310# State Univ. of New York, Stony Brook. Dept. of Physics.
OBSERVATION OF INTERACTIONS BETWEEN TWO SUPERCONDUCTING PHASE-SLIP CENTERS Technical Report, 1 Feb. - 31 May 1977
D. W. Jillie, J. E. Lukens, and Y. H. Kao 13 Jul. 1977 5 p refs Repr. from Phys. Rev. Letters, v. 38, no. 16, 18 Apr. 1977 p 915-918
(Contract N00014-75-C-0769)
(AD-A043667) Avail: NTIS HC A02/MF A01 CSCL 20/13

A superconducting microbridge was used as a probe to detect quasiparticle diffusion currents and heating, produced by a phase-slip center (PSC) in a second microbridge. The critical current of the detector is modulated by the voltage V sub PSC across the PSC. This modulation provides a measure of quasiparticle current I sub Q thru the PSC and gives I sub Q = V sub PSC/R and D for low voltages, R sub O being the high-current differential resistance of the PSC. Author (GRA)

N78-11311# Harry Diamond Labs., Adelphi, Md.
VOLTAGE AND CURRENT MEASUREMENTS IN HIFX DIODES
Joseph D. Silverstein Aug. 1977 124 p refs
(AD-A043971; HDL-TM-77-6) Avail: NTIS HC A06/MF A01 CSCL 09/3

Capacitive-voltage (V) monitors and shunt-resistor (I) monitors have been fabricated for the Harry Diamond Laboratories High-Intensity Flash X Ray Facility. Sensitivities of these monitors have been measured to an accuracy of 10 percent or better by improved pulse techniques. The monitors were used to measure V and I pulses at charge voltages between 2.0 and 5.0 MV for both high- and low-impedance (Z) diodes. For the high-Z diode, consisting of a hemispherical cathode and a planar anode, Z increases from 70 to 120 ohms as the cathode-anode gap is increased from 1.5 to 3.8 cm. For the low-Z diode, whose cathode and anode are both planar, Z increases from 7 to 33 ohms as the cathod-anode gap is increased from 0.4 to 1.4 cm. Electron energy spectra calculated from the V and I pulses are in reasonable agreement with those measured previously by means of a magnetic spectrometer. There is also general agreement between the time variation of gamma dose rate calculated from the V and I pulses and that measured with a scintillator-photodiode. However, the doses obtained by integrating the calculated dose rates are, on the average, 70 percent lower than those measured with CaF2:Mn thermoluminescent dosimeters. Author (GRA)

N78-11312# California Univ., Irvine. School of Engineering.
NEW DIRECTIONS FOR CIRCUIT AND SYSTEMS RESEARCH RELEVANT TO ELECTRONIC CIRCUIT APPLICATIONS Final Report
James H. Mulligan Jan. 1977 72 p refs Presented at Workshop, Univ. of Calif., Irvine, 11-13 Apr. 1976
(Grant NSF ENG-75-19564)
(PB-270294/2) Avail: NTIS HC A04/MF A01 CSCL 09E

A workshop reviewed the state-of-the-art of those aspects of network theory research directly relevant to electronic circuit applications and recommendations were formulated regarding those problem areas in which new research effort is deemed particularly appropriate Individuals from both industry and academey, having an intimate knowledge of electronic devices, relevant circuit theory and its application to electronic circuit design, participated. The major sessions of the workshop included solid state circuit design; modeling, computer aided design and simulation; microprocessors and their application. GRA

N78-11313# Sandia Labs., Albuquerque, N. Mex.
DEPOSITION OF MOBILE-ION FREE ALUMINUM AND ALUMINUM ALLOY FILMS FOR HIGH STABILITY MOS GATE STRUCTURES
Donald J. Sharp, Frank Castillo, and Willie J. McCabe Mar. 1977 22 p refs Presented at 12th Ann. Symp. of N. Mex. Chapter of Am. Vacuum Soc., 15-17 Mar. 1976
(Contract EY-76-C-04-0789)
(SAND-76-0647) Avail: NTIS HC A02/MF A01

The use of RF induction-heated crucible evaporation in conjunction with a practical approach for deposition of either aluminum or aluminum alloys for high purity gate-metallization is described, yielding devices which consistently exhibit mobile ion densities of 5 x 10 to the 9th power/sq cm or less. This corresponds to a marginally detectable 0.05 volt shift in flat band voltage for an MOS capacitor with a 1000 A SiO2 dielectric. Techniques are outlined in which large charges of evaporation (40 gms) were purified prior to evaporation by fractionation at 1150 C. Volatile elements such as K, Na, and Li are shown to rapidly distill from the source melt prior to aluminum evaporation. Data are also presented which compare these results to those

obtained using tungsten filament evaporation on gate oxides.
ERA

N78-11314# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.
MODAL EQUIVALENT CIRCUITS FOR GENERALIZED INTERDIGITAL FILTERS
Veikko Porra 1976 5 p refs Presented at the IEEE Intern. Symp. on Circuits and Syst., Munich, 27-29 Apr. 1976 Sponsored by Acad. of Finland
(Rept-S-82; ISBN-951-750-627-9) Avail: NTIS HC A02/MF A01

New equivalent circuits were derived for generalized interdigital filters on the basis of proper orthogonal mode expansions of the voltages and currents on a multiconductor transmission line section. These equivalent circuits contain the minimum number of uncoupled transmission line unit elements. Modal analysis can be extended to lossy and inhomogeneous structures. The application of the new equivalent circuits is illustrated by numerical analysis of even order linear phase filters. It turns out, in this case, that the new equivalent circuit is very close to the circuit derived by Rhodes. Author (ESA)

N78-11315# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.
PARAMETRIC AMPLIFICATION USING A POINT CONTACT JOSEPHSON JUNCTION
Pekka Somervuo 1976 48 p refs
(Rept-S-88; ISBN-951-750-715-1) Avail: NTIS HC A03/MF A01

The use of a point contact Josephson junction as a parametric amplifier was studied at 9 GHz. The junction used in the experiments was a two-hole RF-biased SQUID (Superconducting Quantum Interference Device) and the pump frequency was close to the signal frequency. The total gain achieved was 10 dB with a bandwidth of 3 MHz. Simultaneously a strong noise component was visible in the frequency band where the amplification takes place. On the basis of these observations an analysis of the amplification was carried out. Results show that the observed gain properties are in accordance with the amplifier model in which two idler frequencies simultaneously take part in the amplification process. It is concluded that the choice of the coupling structure between the low impedance junction and the external microwave circuit is good. It can be used in further amplifier realizations and in magnetometer applications where the sensitivity of the system can be improved by using microwave pump power. Author (ESA)

N78-11316# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.
A COMPUTER PROGRAM MODELING THE BEHAVIOR OF A TRANSFERRED ELECTRON DEVICE
David E. Meharry 1977 7 p refs
(Rept-S-92; ISBN-951-750-958-8) Avail: NTIS HC A02/MF A01

A computer program is presented which calculates the behavior of a transferred electron oscillator operating in the quenched domain mode. The program, which is based on previous theoretical work, includes options for the inclusion of diffusion effects, a temperature dependent threshold field, and calculation of the admittance of a packaged device, has no lengthy iterative calculations so that results are obtained very quickly.
Author (ESA)

N78-11317# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.
MEASUREMENT OF THE LOAD ADMITTANCE OF A TRANSFERRED ELECTRON DEVICE
David E. Meharry 1977 13 p refs
(Rept-S-93; ISBN-951-750-959-6) Avail: NTIS HC A02/MF A01

An attempt was made to characterize TED behavior by measurement of the device's load admittance using a special probe arrangement. Difficulties in analysis of the results are explained by a sensitivity analysis on the equivalent circuit of the measurement probe. It is concluded that the present arrangement is inadequate for the characterization. Author (ESA)

N78-11318# Compagnie Internationale de Service en Informatique, Paris (France).
COMPONENT MODELING FOR ELECTRONIC CIRCUIT ANALYSIS Final Report [MODELISATION DE COMPOSANTS POUR L'ANALYSE DES CIRCUITS ELECTRONIQUES]
M. Barocas and J. Terrier 28 Jul. 1977 12 p refs
(Contract ESTEC-2723/76-NL-AK)
(ESA-CR(P)-969) Avail: NTIS HC A02/MF A01

Computer models of passive components, diodes, transistors, and logic and linear integrated circuits were developed for the analysis of electronic circuits. The models were selected and the parameters of corresponding types were measured. The models were validated by comparison of simulation results and measurements. The concordance was generally found to be satisfactory. A library of models in the IMAG8 language was stored in the ICL 4/72 computer at ESTEC. ESA

N78-11319# European Space Research and Technology Center, Noordwijk (Netherlands).
MEASUREMENT OF SURFACE AND VOLUME RESISTIVITY OF HUGHSON H322 BLACK PAINT WITH LESANOL PRIMER
S. J. Bosma and F. Levadou Paris ESA Sep. 1977 20 p refs
(ESA-TM-173) Avail: NTIS HC A02/MF A01

The measurement of surface and volume resistivity of Hughson H322 conductive black paint with Lesanol primer is described and the consequences of applying it to the ISEE-B satellite with regard to electrostatic cleanliness requirements was studied. It is shown that although under certain conditions the surface conductance may not be sufficient to reduce the charge to a 1 V potential level, these conditions are not critical, since the charge will easily be removed through the second conduction path, which is through the volume of the paint plus primer to the underlying aluminum substrate. Author (ESA)

N78-11320# Hughes Research Labs., Malibu, Calif.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: SOME ASPECTS OF DOSE MEASUREMENT FOR ACCURATE ION IMPLANTATION
Douglas M. Jamba Jul. 1977 48 p refs
(Contract NBS-5-35891; ARPA Order 2397)
(PB-269776/1; NBS-SP-400-39; LC-77-24724) Avail: NTIS HC A03/MF A01 CSCL 09A

Various phases of semiconductor ion implantation dose measurement were investigated covering in detail ion beam scanning, secondary particle suppression, and current measurement instruments. Problems are discussed and preferred techniques, electrode structures, and measurement circuitry are presented. Five current integrators were tested and are compared, especially in regard to pulsed current measurement.
GRA

N78-11149*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
S-/X-BAND MICROWAVE OPTICS DESIGN AND ANALYSIS FOR DSN 34-METER DIAMETER ANTENNA
D. L. Nixon and D. A. Bathker *In its* The Deep Space Network 15 Oct. 1977 p 146-165 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

N78-11939# Case Western Reserve Univ., Cleveland, Ohio.
OBSERVATIONS WITH A ONE SQUARE METER BALLOON-BORNE GAMMA-RAY DETECTOR IN THE ENERGY RANGE ABOVE 10 MeV
P. Albats, B. Denehy, G. M. Frye, T. L. Jenkins, R. Koga, and S. M. Schindler *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 287-291 refs Sponsored by NSF (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N78-11321 Rutgers - The State Univ., New Brunswick, N. J.
INVESTIGATION OF THE DIFFUSION IN TURBULENT SHEAR FLOW Ph.D. Thesis
Baochuan Bernard Hwang 1977 86 p
Avail: Univ. Microfilms Order No. 77-17539

Corrsin's Independence Hypothesis (1959) in statistical turbulence theory as applied to homogeneous uniform flow is discussed, and the hypothesis is extended to a flow with uniform shear gradient. This problem has intrinsic importance in the study of diffusion of pollutants in the lower atmosphere surface layer. By use the Eulerian space-time correlation data measured in the atmospheric surface layer under unstable conditions, parameters for the extended hypotheses are obtained. A diffusion model for this turbulent shear flow is proposed, based on the concept of turbulent diffusivities and the dispersion tensor. A set of equations is obtained for the diffusivity tensor and dispersion tensor in terms of the statistical correlation tensors of the Lagrangian velocity field. The solutions of these equations together with the diffusion equations can be expressed as a multinormal distribution function using the initial condition of instantaneous point source. Dissert. Abstr.

N78-11322 Iowa State Univ. of Science and Technology, Ames.
EXPERIMENTAL INVESTIGATION OF FLOW BETWEEN ROTATING SPHERES Ph.D. Thesis
Adnan Mohammad Waked 1977 188 p
Avail: Univ. Microfilms Order No. 77-16982

For low Reynolds numbers the basic laminar flow is very spherical in character, while for large Reynolds numbers the flow may become very two-dimensional, depending on the values of the radius ratio (nu) and the angular velocity ratio (mu). For a stationary outer sphere and at sufficiently large Reynolds numbers the transition to turbulent may occur directly from the basic laminar flow without an intermediate Taylor vortex type laminar flow. Results show that for nu>0.46 the smaller the gap the Re sub cr is, while for nu<0.46 the larger the gap the higher Re sub cr will be. When both spheres rotate, the flow may be either entirely laminar, entirely turbulent or some combination of laminar and turbulent flow. The flow field consists of a turbulent circular cylinder about the axis of rotation surrounded by a laminar region. The sizes of these regions depend on the values of the angular velocities of the spheres. Dissert. Abstr.

N78-11323 Ecole Polytechnique Federale de Lausanne (Switzerland). Inst. de Thermique Appliquee.
MEASURING TECHNIQUES IN TRANSONIC AND SUPERSONIC CASCADES AND TURBOMACHINES
Albin Boelcs, ed. and Torsten Fransson, ed. Zurich Juris-Verlag 1977 187 p refs Proc. of the Symp. held in Lausanne, Switz., 18-19 Nov. 1976
(EPFL-ITA-5; ISBN-3-260-04262-7) Avail: Juris-Verlag Sw.Fr. 16

Contributions are presented in the field of transonic and supersonic turbine cascade flow measurements. Topics covered are in general: measurements using probes, laser anemometry in transonic fields, new measurement techniques, and unsteady flow effects. Areas open for further investigation were found to be: high frequency flow field pulsation, measurement technique in unsteady cascade flow, and periodicity in plane cascades. The effect of the presence of probes in the flow field was noted, and the interest in wall measurements, global control, and optical methods reviewed. For individual titles, see N78-11324 through N78-11339.

N78-11324 Sulzer Bros. Ltd., Winterthur (Switzerland).
DEVELOPMENT AND APPLICATION OF A CONVENTIONAL COMBINED PRESSURE, TEMPERATURE AND ANGLE PROBE WITH SMALL DIMENSIONS
Christian Guedel *In* Ecole Polytech. Federale de Lausanne Meas. Tech. in Transonic and Supersonic Cascades and Turbomachines 1977 p 9-30 (For availability see N78-11323 02-34)
Avail: Juris-Verlag Sw.Fr. 16

The development and application of a conventional probe for flow field measurement in axial compressor stages is described. The probe has small dimensions to enable it to be traversed in an axial gap of 12 mm between rotor and stator blades maintaining a minimum safety clearance of 3 mm. It allows simultaneous detection of total pressure and static pressure, total temperature and flow angle. Five prototypes were developed, and the final probe design was calibrated. An application to flow measurement in the blade passage of a multistage test compressor is described. ESA

N78-11325 Technische Hochschule, Aachen (West Germany). Inst. fuer Strahlantriebe und Turbomaschinen.
MULTI-PARAMETER APPROXIMATION OF CALIBRATING VALUES FOR MULTI-HOLE PROBES
Heinz E. Gallus and Dieter Bohn *In* Ecole Polytech. Federale de Lausanne Meas. Tech. in Transonic and Supersonic Cascades and Turbomachines 1977 p 31-37 (For availability see N78-11323 02-34)
Avail: Juris-Verlag Sw.Fr. 16

A method is presented for calculating the calibration spheres and calibration spacers of subsonic and supersonic probes by multiparameter approximation functions. It is shown that the calibration spheres and spacers can be replaced by only one function. The coefficients of such a function being known, the calculation of data measured by five-hole probes in the flow field is considered to be relatively easy. No interpolation nor iteration is necessary to determine the flow characteristics. ESA

N78-11326 Brown, Boveri and Co., Ltd., Baden (Switzerland). Abt. TX 2.
CALIBRATING TEST SECTIONS FOR CALIBRATION OF AERODYNAMIC PROBES
Franz Kreitmeier *In* Ecole Polytech. Federale de Lausanne Meas. Tech. in Transonic and Supersonic Cascades and Turbomachines 1977 p 39-53 refs (For availability see N78-11323 02-34)
Avail: Juris-Verlag Sw.Fr. 16

Some axisymmetric nozzles were tested as part of an experimental investigation of free jet test sections for calibration of aerodynamic probes. A considerable probe - shaft influence was observed in the higher subsonic region. The suitability of subsonic test sections using convergent nozzles was demonstrated. For the supersonic range, test sections obtained with a ventilated and a convergent-divergent nozzle were found to be unsuitable. Author (ESA)

N78-11327 Stuttgart Univ. (West Germany). Inst. fuer Aerodynamik und Gasdynamik.
A LASER HOLOGRAPH FOR INVESTIGATION OF TWO-DIMENSIONAL TRANSONIC CASCADE FLOW
Karl Einsfeld *In* Ecole Polytech. Federale de Lausanne Meas. Tech. in Transonic and Supersonic Cascades and Turbomachines 1977 55-63 ref (For availability see N78-11323 02-34)
Avail: Juris-Verlag Sw.Fr. 16

A simple optical arrangement with a laser light source was constructed for interferometric and holographic flow measurements and applied to a cascade test section. The arrangement selected for cascade flow investigation is a double exposure holograph. Problems in optimizing the installation and construction are outlined. Measured and calculated flow fields were compared, and the accuracy of the measurement was found to be as good as that of the calculation. ESA

N78-11328 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Luftstrahlantriebe.
EXPERIMENTAL INVESTIGATION OF SUPERSONIC INFLOW OF A COMPRESSOR CASCADE BY THE LASER-2-FOCUS-METHOD
Peter Schimming *In* Ecole Polytech. Federale de Lausanne Meas. Tech. in Transonic and Supersonic Cascades and Turbomachines 1977 p 65-72 refs (For availability see N78-11323 02-34)
Avail: Juris-Verlag Sw.Fr. 16

Measurements in a transonic inlet flow field of a compressor cascade using the laser-2-focus (L2F) method are described. The

tests were carried out in the supersonic cascade wind tunnel of the DFVLR. Accuracy of the transonic inlet flow angle measurements using conventional methods is about plus or minus 2 deg or worse. The L2F system allows obtaining accuracies of plus or minus 0.1 deg (low turbulence level in the inflow). ESA

N78-11329 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

UNSTEADY FLOW MEASUREMENTS IN STRAIGHT CASCADES

Claus H. Sieverding *In* Ecole Polytech. Federale de Lausanne Meas. Tech. in Transonic and Supersonic Cascades and Turbomachines 1977 p 73-82 refs (For availability see N78-11323 02-34)

Avail: Juris-Verlag Sw.Fr. 16

Measurements are reported of unsteady outlet flow in a cascade wind tunnel. The cascade test section was fitted with pressure transducers. Results are presented on cascade tunnel unsteadiness and blade wake unsteadiness. No conclusions could be drawn as to the pressure variation involved in this type of flow unsteadiness. ESA

N78-11330 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Luftstrahlantriebe.

A NEW TECHNIQUE FOR CONTROLLING THE EXIT FLOW PERIODICITY OF SUPERSONIC CASCADES

Hans Starken *In* Ecole Polytech. Federale de Lausanne Meas. Tech. in Transonic and Supersonic Cascades and Turbomachines 1977 p 83-86 ref (For availability see N78-11323 02-34)

Avail: Juris-Verlag Sw.Fr. 16

A solution is proposed for controlling the outlet flow periodicity of supersonic cascades. This consists in a slotted tailboard combined with an attached chamber. The tailboard is similar to the ones used in normal transonic wind tunnels, but also needs to provide the necessary back pressure. This is done by feeding the pressure just upstream of the throttle through the chamber to the open slots. ESA

N78-11331 Ecole Polytechnique Federale de Lausanne (Switzerland). Inst. de Thermique Appliquee.

A NEW CONFIGURATION OF WIND TUNNEL AND SOME EXPERIENCE WITH AN ANNULAR CASCADE FOR TRANSONIC FLOW CONDITIONS

Albin Boelcs and Torsten Fransson *In its* Meas. Tech. in Transonic and Supersonic Cascades and Turbomachines 1977 p 87-101 ref (For availability see N78-11323 02-34)

Avail: Juris-Verlag Sw.Fr. 16

A new type of wind tunnel was developed to investigate experimentally the transonic flow in annular cascades. The test rig permits variations of the medium velocities and flow angles in the test section, as well as of the velocity and flow angle distributions over the channel height. Flow measurements were made in a transonic turbine cascade with a small aspect ratio ($H/S = 0.19$). A comparison between the profile Mach numbers measured on the outer wall of the test section and in the middle of the channel shows a fairly good agreement on the pressure side, but a greater deviation is found on the suction side of the blade. This is due to the clearance flow. By attaching end plates to the tip of the blades, the clearance flow was reduced. In this case, the difference between the measured profile Mach numbers in the middle of the channel and on the outer wall was also reduced. The flow velocity in the cascade with end plates, compared to the case without end plates, increases in the case of identical upstream conditions. Author (ESA)

N78-11332 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

CASCADE TEST METHODS IN WIND TUNNNEL AT ONERA

J. Leynaert *In* Ecole Polytech. Federale de Lausanne Meas. Tech. in Transonic and Supersonic Cascades and Turbomachines 1977 p 103-116 refs (For availability see N78-11323 02-34)

Avail: Juris-Verlag Sw.Fr. 16

Cascade test methods were developed by using the main chamber of a supersonic wind tunnel converted for cascade tests. As a result of the high wind tunnel pressure ratio, 5:1, it is possible to choke mass flows of the cascade test rig by independent sonic throats and to bleed controlled quantities of the sidewall boundary layer. Various aspects of the cascade tests are discussed: flow boundaries definition, sidewall boundary layer bleed device, converging sidewall definition, and flow measurement. ESA

N78-11333 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.

EXPERIMENTAL INVESTIGATION OF THE FLOW FIELD DOWNSTREAM OF A PLANE TURBINE CASCADE IN TRANSONIC FLOW

Reinhard Kiock *In* Ecole Polytech. Federale de Lausanne Meas. Tech. in Transonic and Supersonic Cascades and Turbomachines 1977 p 117-131 refs (For availability see N78-11323 02-34)

Avail: Juris-Verlag Sw.Fr. 16

The measurement of total pressure, static pressure, and flow angle at several distances close behind a turbine cascade, using a 3-finger probe is described. Average values are evaluated from these local values by means of the laws of conservation. The flow field is discussed on the basis of these wake flow quantities and of the Schlieren picture. Investigations were carried out in the high speed cascade wind tunnel at an isentropic Mach number of 1.00 and at a Reynolds number of 5 to the 5th power. Author (ESA)

N78-11334 GEC Turbine Generators Ltd., Manchester (England). Fluid Flow Labs.

MEASUREMENTS IN TRANSONIC STEAM TURBINE CASCADES

V. T. Forster *In* Ecole Polytech. Federale de Lausanne Meas. Tech. in Transonic and Supersonic Cascades and Turbomachines 1977 p 133-139 refs (For availability see N78-11323 02-34)

Avail: Juris-Verlag Sw.Fr. 16

Work on supersonic cascade testing of long lasting L. P. blades in steam turbines is described. The main tasks reported are: the testing of optimum profiles for supersonic flows both for fixed and moving rows up to Mach numbers of 2.0, and the testing of profiles for near root and tip in the transonic range at inlet, Mach numbers of 0.6 to 1.2. ESA

N78-11335 Central Electricity Research Labs., Leatherhead (England).

L. P. TURBINE TIP SECTION IN WET STEAM FLOW

N. B. Wood *In* Ecole Polytech. Federale de Lausanne Meas. Tech. in Transonic and Supersonic Cascades and Turbomachines 1977 p 141-152 refs (For availability see N78-11323 02-34)

Avail: Juris-Verlag Sw.Fr. 16

Some examples are given of calculated nonequilibrium flows through steam turbine blade passages, and the C.E.R.L. wet steam tunnel, in which various fundamental experimental studies have been made, is described. Details are given of the cascade working section built for the study of flow through a transonic rotor tip section typical of the final stage of a 500 MW turbine. ESA

N78-11336 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Aerodynamische Versuchsanstalt.

COMPARISON OF 2-D-CASCADE TESTS DONE IN THE VKI AND AVA CASCADE WIND TUNNELS

O. Lawaczek *In* Ecole Polytech. Federale de Lausanne Meas. Tech. in Transonic and Supersonic Cascades and Turbomachines 1977 p 153-154 refs (For availability see N78-11323 02-34)

Avail: Juris-Verlag Sw.Fr. 16

The characteristic data of a high speed gas turbine cascade were measured in the wind tunnels for straight cascades and for rotating (annular) cascades of the AVA-DFVLR at Goettingen. The outlet flow conditions were varied from subsonic to supersonic velocities. Rotation and losses measured in the facilities were compared to measurements carried out in the VKI cascade wind tunnel. The surface pressure distribution measured in the straight cascade wind tunnels of VKI and AVA were also compared. Results are summarized. ESA

N78-11337 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Aerodynamische Versuchsanstalt.

COMPARISON OF 2-D AND ROTATION MEASUREMENTS

OF CASCADES WITH FLAT PLATE PROFILES
Hans-Joachim Heinemann *In* Ecole Polytech. Federale de Lausanne Meas. Tech. in Transonic and Supersonic Cascades and Turbomachines 1977 p 155-156 refs (For availability see N78-11323 02-34)
Avail: Juris-Verlag Sw.Fr. 16

Two flat plate cascades of different geometry were investigated in the 2-D cascade wind tunnel and the facility for rotating (annular) cascades to compare the results. Measurements were also made on a tip-section cascade, also examined at VKI, Rhode St. Genese, Belgium. The outlet flow conditions were varied from subsonic to supersonic velocities. Wake flow measurements were compared in the case of flat plate cascades for both DFVLR-AVA facilities. Surface pressure and wake flow measurements were compared with VKI-results for the tip-section cascade. Results are summarized. ESA

N78-11338 Lyon Univ. (France). Lab. de Mecanique des Fluides.
MEASUREMENTS OF SECONDARY FLOWS IN A TRANSONIC AXIAL-FLOW COMPRESSOR
Gerard Bois, F. Leboeuf, A. Comte, and K. D. Papailiou *In* Ecole Polytech. Federale de Lausanne Meas. Tech. in Transonic and Supersonic Cascades and Turbomachines 1977 p 157-172 refs Sponsored by SNECMA (For availability see N78-11323 02-34)
Avail: Juris-Verlag Sw.Fr. 16

Measurements were performed using two different probes (at an angle of 90 deg) at one station upstream and one station downstream of the rotating wheel of a transonic compressor in order to study the behavior of viscous shear layers near the end walls of the compressor. Special probes were developed for the stationary or rotating hub, and the stationary tip. The probes were calibrated in a uniform stream and examined for use in the transonic compressor. The interpretation of their measurements is discussed. ESA

N78-11339 Stuttgart Univ. (West Germany). Inst. fuer Aerodynamik und Gasdynamik.
ANALYSIS OF THE UNSTEADY FLOW IN A TURBINE STAGE WITH DIFFERENT METHODS
Karl Einsfeld *In* Ecole Polytech. Federale de Lausanne Meas. Tech. in Transonic and Supersonic Cascades and Turbomachines 1977 p 173-183 refs (For availability see N78-11323 02-34)
Avail: Juris-Verlag Sw.Fr. 16

Several flow measurement techniques were examined with a view to determining their usefulness in the analysis of the unsteady flow in a turbine stage. The techniques discussed are: Mach-Zehnder interferometer together with a high speed rotating mirror camera, semiconductor strain gage to measure profile vibration, and hot-wire anemometer to increase the flow velocity field. ESA

N78-11340*# Cambridge Hydrodynamics, Inc., Mass.
PREDICTION OF COMPLIANT WALL DRAG REDUCTION, PART 1
Steven A. Orszag Nov. 1977 42 p refs
(Contract NAS1-14275)
(NASA-CR-2911) Avail: NTIS HC A03/MF A01 CSCL 20D

Computer codes developed to test Bushnell's compliant wall drag reduction model are discussed. One code computes the evolution of mean velocity profiles during the period between bursts as forced by an imposed large-scale pressure pulse due to earlier bursts. Another code computes the local stability characteristics of these computed profiles. The programs use Chebyshev polynomials to resolve the normal boundary layer (y) direction and a staggered grid of mesh points to resolve the x direction. Typically, 257 grid points and 33 Chebyshev polynomials are used in the computations. Author

N78-11341# Naval Research Lab., Washington, D. C.
CALCULATION OF GAS TEMPERATURES IN N2 PRESSURIZATION EXPERIMENTS
W. W. Jones, J. P. Boris, and E. S. Oran Jun. 1977 11 p refs
(rr0240241)
(AD-A043121; NRL-MR-3542) Avail: NTIS HC A02/MF A01 CSCL 20/4

Estimates have been made of maximum temperature ratios for a preliminary version of the nitrogen pressurization experiments. These calculations are to determine the feasibility of using temperature as a diagnostic in such experiments. The limits considered are unmixed and fully mixed gases in the experimental chamber. The actual experimental conditions will fall somewhere between these two limits. In both cases, temperature would appear to be a reasonable diagnostic tool. GRA

N78-11342# Pennsylvania State Univ., University Park.
ROTOR INCOMING VELOCITY PROFILE MEASUREMENTS
M. L. Billet 11 Oct. 1976 48 p refs
(Contract N00017-73-C-1418)
(AD-A043025; TM-76-254) Avail: NTIS HC A03/MF A01 CSCL 20/4

Boundary layer profiles were measured for various flow conditions at a position in front of a rotor. The rotor was located at the downstream end on an axisymmetric body. Results were obtained with/without upstream appendages, with/without upstream screen, and for an design/off design rotor flow coefficients. All tests were conducted in the 48-inch diameter wind tunnel at a nominal velocity of 80 fps. Author (GRA)

N78-11343# Pennsylvania State Univ., University Park.
CAVITATION RESULTS FOR A SECONDARY FLOW GENERATED TRAILING VORTEX Applied Research Lab.
M. L. Billet 24 Aug. 1976 25 p refs
(Contract N00017-73-C-1418)
(AD-A043024; TM-76-234) Avail: NTIS HC A02/MF A01 CSCL 20/4

Limited cavitation numbers were obtained for a trailing vortex generated by the interaction of a boundary layer and a rotor when the boundary layer thickness is the same order of magnitude as the rotor radius. The results were obtained for various boundary layer profiles and velocities in the 48-inch diameter water tunnel. Author (GRA)

N78-11344# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
TURBULENCE MEASUREMENTS OF A TWO-DIMENSIONAL HELIUM JET IN A MOVING AIRSTREAM
Paul Anderson (California Univ., La Jolla), John C. LaRue (California Univ., La Jolla), and Paul A. Libby (California Univ., La Jolla) Jul. 1977 79 p refs
(Contract N00014-75-C-1143)
(AD-A043041; SQUID-UCSD-9-PU) Avail: NTIS HC A05/MF A01 CSCL 20/4

Measurements of the streamwise velocity component and the concentration of helium are made in a two-dimensional helium jet discharging into a moving airstream. The transverse distribution of the unconditioned and conditioned statistics of the velocity and helium concentration at various downstream positions are presented. In addition, range conditioned point statistics provide information on the structure of turbulent zones of various durations. The gross properties of the jet agree with previous data. Entrainment is found to occur on the leeward edges of the turbulent zones; because the turbulent fluid is moving faster than the external stream these edges are on the upstream end of the zones. The interfaces as given by the velocity and concentration cannot be distinguished and are found to be relatively thicker than previously measured temperature interfaces. Author (GRA)

N78-11345# Weidlinger Associates, New York.
ON UNCOUPLING STRUCTURE-FLUID INTERACTION PROBLEMS; STATUS REPORT ON THE IDCA
H. H. Bleich, F. L. Dimaggio, D. Ranlet, and M. L. Baron May 1977 23 p refs
(Contract N00014-72-C-0119)
(AD-A043356) Avail: NTIS HC A02/MF A01 CSCL 20/4

A concerted effort has been made to analyze submerged structures under explosive loadings, by utilizing the Doubly Asymptotic Approximation (DAA), to account for the structure-fluid interaction. The current implementation of the DAA employs a modal analysis for the structure and a set of orthogonal functions (surface expansion functions) for the fluid, the latter being used to improve the conditioning of the governing response equations. The DAA yields exact results for high and low frequencies and

produces a smooth transition between these limits. Since a more accurate fit at intermediate frequencies may prove to be important in some problems of interest, the DAA may prove to be inadequate in some cases. The Inertial-Damping Collocation Approximation (IDCA), gives exact results for low, high, and selected intermediate frequencies, and as such represents a potential improvement over the DAA. GRA

N78-11346# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

SINGULAR PERTURBATION METHODS APPLIED TO THE DYNAMICS AND RHEOLOGY OF SUSPENSIONS Final Report, 1 Jul. 1973 - 30 Apr. 1977

I-Dee Chang 10 Jul. 1977 9 p refs

(Contract DAAG29-73-C-0034)

(AD-A043342; ARO-11032.3-E) Avail: NTIS HC A02/MF A01 CSCL 20/4

Non-linear hydrodynamic interaction on particles suspended in viscous flows was investigated analytically by the method of matched expansions. In particular, three problems of fundamental importance were analyzed. The first problem involves the motion of a particle in an oscillating viscous shear flow. It was found that because of the inertia of the fluid, a lift force is produced on the particle. This force has a d-c component which tends to cause a sidewise drift of the particle. The second problem involves the extension of Jeffery's classical work on the motion of ellipsoidal particles immersed in a viscous shear flow. It was found that the first order outer solution corresponds to gyrating dipoles in a shear flow. The effect of the shear produces a higher order effect than the one caused by the second order non-linear effect in the near field. The third problem dealt with the motion of a spherical particle in a viscous compressible flow. The flow field was calculated in terms of a near field and a far field. The flow pattern is rather complex because of the combined effects of heat conduction and viscosity. Author (GRA)

N78-11347# Massachusetts Inst. of Tech., Cambridge.

GERSTNER WAVES AT THE INTERFACE BETWEEN STRATIFIED FLUIDS Dept. of Meteorology.

Erik Mollo-Christensen Jun. 1977 6 p refs

(Contract N00014-76-C-0413)

(AD-A043431) Avail: NTIS HC A02/MF A01 CSCL 20/4

Paper extends the theory of Gerstner waves by the addition of a fluid layer in rigid body motion above the surface of the conventional Gerstner wave field. The propagation speed is then decreased by a factor of Square root of (Delta RHO/RHO). The same result is also valid for the system turned upside down with a reversal of the density difference. Combining the flows, one can also construct a three-fluid system with a middle layer in uniform motion in the plane of Gerstner waves, while the flow normal to this plane can be arbitrary and must be steady. GRA

N78-11348# Oklahoma State Univ., Stillwater. Fluid Power Research Center.

MERADCOM/OSU HYDRAULIC SYSTEM RELIABILITY PROGRAM. SECTION 1: HYDRAULIC NOISE ATTENUATION Annual Report, Feb. 1976 - Feb. 1977

G. E. Maroney Feb. 1977 82 p refs

(Contract DAAK02-75-C-0137)

(AD-A043633; OSU-FPRC-7M1) Avail: NTIS HC A05/MF A01 CSCL 20/1

This section presents a detailed account of the project activities in the area of hydraulic noise. Specific test procedures are recommended for determining the fluidborne noise generation potential of hydraulic pumps and the acoustical performance characteristics of fluidborne noise attenuators. Experimental data are shown to indicate typical results that are obtained with the proposed test codes. GRA

N78-11349# Pennsylvania State Univ., University Park. Applied Research Lab.

ULTRASONIC SHEAR VISCOMETER FOR LIQUID DROPLETS AND ITS APPLICATIONS Ph.D. Thesis. Technical Report, period ending Aug. 1977

Edward Shalis 25 Apr. 1977 87 p refs

(Contract N00017-73-C-1418)

(AD-A043590; TM-77-207) Avail: NTIS HC A05/MF A01 CSCL 20/4

An ultrasonic viscometer, capable of measuring small liquid volumes such as drops, was developed by utilizing the short effective path length of shear waves in liquids. The viscometer consists of an unplated quartz crystal excited to shear vibrations with the liquid drop to be tested placed on its surface. The vibrations of the natural modes of the quartz plate were represented by a mass-point compliant equation, and the viscosity equation was derived from the knowledge of the energy loss. Suitable electronics was built to drive the crystal and to record the decaying vibrations. A crystal orientation analysis insured a dominant thickness-shear mode not coupled to flexure and face-shear motion. The amount of sound radiated was determined from the change in the quality factor when the crystal was vibrating alone in air and under vacuum. GRA

N78-11350# Illinois Univ., Urbana-Champaign. Water Resources Center.

BUOYANT SURFACE JETS DISCHARGED INTO A STRONG CROSSFLOW

Edward R. Holley, W. Hall, and C. Maxwell Apr. 1977 236 p refs

(Contract DI-14-31-0001-5071)

(PB-270455/9; UILU-WRC-77-0124) Avail: NTIS HC A11/MF A01 CSCL 13B

Analytical and experimental investigations were carried out for three dimensional buoyant surface jets with strong ambient flow but without boundary attachment. A numerical model in curvilinear coordinates was developed from an integral jet analysis modified for buoyancy effects and included asymmetry of the jet. Detailed temperature distributions were measured in the laboratory with densimetric Froude numbers (F sub o) of 5, 10, and 15 and velocity ratios (R) from 2 to 13. Experimental results showed that ambient crossflows can cause significant distortion of the jet, even for R = 13. Near the exit, the lower portion of the jet is swept toward the lee side of the jet. GRA

N78-11351# California Univ., Livermore. Lawrence Livermore Lab.

FLOW-REGIME CHARACTERIZATION FOR HORIZONTAL TWO-PHASE STEAM FLOW

Clarence A. Calder 5 Oct. 1976 30 p refs

(Contract W-7405-eng-48)

(UCRL-52186) Avail: NTIS HC A03/MF A01

A relatively simple model, using Baker parameters, is described and applied to flow-regime data generated by high speed photography of two-phase steam flow. Although results depend somewhat on the personal judgment and interpretation of the observer, the model was found to give a reasonable prediction of the flow regime for the flow ranges available in 1- and 2-in.-diam pipes. ERA

N78-11352# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Department d'Etudes et de Recherches en Technologie Spatiale.

QUALIFICATION OF THERMAL CONTROL COATINGS FOR ULTRAVIOLET AND PARTICLE RADIATION IN SPACE Final Report

A. Paillous Jul. 1975 179 p refs In FRENCH Report will also be announced as translation ESA-TT-387

(Contract ESTEC-2015/73-JS)

(ONERA-DERTS-29/4025/TS) Avail: NTIS HC A09/MF A01

Degradation of the solar reflection factor in nine types of thermal control coatings was investigated during a simulated 7-7r exposure to the environment encountered in geosynchronous orbit by the north and south surfaces of the OTS satellite. Irradiation and measurements were made under secondary vacuum. A simultaneous exposure to ultraviolet radiation was effected in the 200-380 nm band by electrons of 200 KeV and protons of 2 40 and 150 KeV. Test principles, equipment used, operating conditions, and results are described. A method for modeling degradation as a function of time is proposed. ESA

N78-11353# Aeronautical Research Inst. of Sweden, Stockholm.

FLOW DISTURBANCES ASSOCIATED WITH PRESTON TUBES IN TURBULENT BOUNDAY LAYERS

Arild Bertelrud 1977 62 p refs

(Contract FMV-FK-82223-73-009-07-001;

FMV-FK-82223-74-001-07-001;
FMV-FK82223-75-007-07-001)
(FFA-127) Avail: NTIS HC A04/MF A01; Almqvist and Wiksell, Stockholm Sw.Kr. 30

Disturbances from a surface cylinder aligned with the flow in turbulent boundary layers were investigated in order to study the flow around Preston tubes. Mean velocities and rms values of the fluctuations were obtained in the center plane of the cylinder when immersed in turbulent pipe flow. A rough estimate of the drag due to the surface cylinder was also obtained in this case. The pressure distribution near the cylinder was measured in a flat plate boundary layer, and flow visualizations were made with the oil flow technique. In addition, smoke pictures of the flow were obtained for cases when the boundary layer thickness on the plate was negligible compared to the tube diameter.
Author (ESA)

N78-11354# Association Aeronautique et Astronautique de France, Paris.
PRESENT TRENDS IN MODELLING METHODS FOR TURBULENT FLOWS [TENDANCES ACTUELLES DANS LES METHODES DE MODELISATION DES ECOULEMENTS TURBULENTS]
J. N. Gence, D. Jeandel, and J. Mathieu Paris Assoc. Aeron. et Astronautique de France 1977 49 p refs In FRENCH Presented at the 13th Colloq. d'Aerodyn. Appl., Lyon, 8-10 Nov. 1976
(AAAF-NT-77-01) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

Fundamental ideas underlying the existing models for turbulent flow are reviewed. Emphasis is placed on the closure law problem seen in spectrum space through the use of Fourier transformation, functionals, and tensor analysis. The agreement with practical applications is fair whenever the spectral equilibrium is not externally distorted. ESA

N78-11355# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Aerothermodynamique.
PROGRESS IN THE CALCULATION OF TWO AND THREE DIMENSIONAL TURBULENT BOUNDARY LAYERS
J. Cousteix Paris Assoc. Aeron. et Astronautique de France 1977 31 p refs In FRENCH; ENGLISH summary Presented at the 13th Colloq. d'Aerodyn. Appl., Lyon, 8-10 Nov. 1976
(AAAF-NT-77-02; ISBN-2-7170-0419-X) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

The main types of methods for calculating turbulent flows are reviewed in the frame of their application to boundary layer prediction. Their performances are evaluated by means of comparisons with various experiments in two-dimensional flow. The use of these methods is also discussed in the case of three-dimensional boundary layers. Author (ESA)

N78-11356# Poitiers Univ. (France). Centre d'Etudes Aerodynamiques et Thermiques.
STRONG AND LOOSE COUPLING BETWEEN A BOUNDARY LAYER AND THE EXTERNAL FLOW [COUPLAGE FORT ET COUPLAGE FAIBLE ENTRE COUCHE LIMITE ET ECOULEMENT EXTERIEUR]
R. AlziarydeRoquefort Paris Assoc. Aeron. et Astronautique de France 1977 54 p refs In FRENCH Presented at the 13th Colloq. d'Aerodyn. Appl., Lyon, 8-10 Nov. 1976
(AAAF-NT-77-04; ISBN-2-7170-0421-I) Avail: NTIS HC A04/MF A01; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

The advantages of asymptotic methods with coupling between a turbulent boundary layer and the external flow are discussed. The main results for regular coupling are discussed and the interest of the asymptotic methods in the case of singularities is emphasized. Algorithms are given for subcritical and supercritical boundary layers with integration in the return flow zone. The problems related to direct coupling and asymptotic methods in the case of turbulent flows are discussed. ESA

N78-11357# Poitiers Univ. (France). Centre d'Etudes Aerodynamiques et Thermiques.
NUMERICAL SIMULATION OF SHEAR TURBULENCE [SIMULATION NUMERIQUE DE LA TURBULENCE CISAILLEE]
M. Bouriot and L. F. Tsen Paris Assoc. Aeron. et Astronautique de France 1977 31 p refs In FRENCH Presented at the 13th Colloq. d'Aerodyn. Appl., Lyon, 8-10 Nov. 1976
(Contract DRME-75/354)
(AAAF-NT-77-05; ISBN-2-7170-0422-X) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

A method to numerically solve the Navier-Stokes equations for shear turbulence of a bidimensional flow is presented using the finite difference theory and introducing a controlled energy injection. An excitation term is therefore inserted in the RMS of the Navier-Stokes equation with a Markovian time dependence. A staggered grid is used for the discretization of the partial derivative equations. The data stored on magnetic tape allow a visualization of the current lines, isobaric lines, and turbulence through the use of chronophotography. The results are discussed. ESA

N78-11358# Association Aeronautique et Astronautique de France, Paris.
TWO-DIMENSIONAL TURBULENT SEPARATED FLOW. COMPARISON OF CRITERIA FOR INDUSTRIAL APPLICATION [DECOLLEMENTS TURBULENTS BIDIMENSIONNELS. COMPARAISON DE CRITERES A USAGE INDUSTRIEL]
Y. Semezis and M. Robert 1977 20 p refs In FRENCH Presented at the 13th Colloq. d'Aerodyn. Appl., Lyon, 8-10 Nov. 1976
(AAAF-NT-77-09; ISBN-2-7170-0426-2) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

The criteria of Michel-Quemard-Cousteix, Nikuradze and Stratford are compared in regard to assistance to the profile industrial design engineer. The comparison was performed on the NACA 0012 and GA(W)-1 profiles. It is shown that the Stratford criterion is good in turbulent flow; the others do not allow for a precise determination of the separation point but may be used to qualitatively compare the profile. ESA

N78-11359# Association Aeronautique et Astronautique de France, Paris.
ABLATION CALCULATIONS FOR THE FRONT TIP OF A REENTRY BODY [METHODE DE CALCUL DE L'ABLATION DE LA POINTE AVANT D'UN CORPS DE RENTREE]
J. C. Paulat 1977 18 p refs In FRENCH Presented at the 13th Colloq. d'Aerodyn. Appl., Lyon, 8-10 Nov. 1976
(AAAF-NT-77-10; ISBN-2-7170-0427-0) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 15 (France and EEC) FF 19 (others)

Calculation methods applicable to reentry nose cones are reviewed. It is shown that for reentry velocities so great that the aerodynamic fluxes are severely perturbed, the nose cone shape variation must be taken into account. Various criteria used to define the transition zone are presented including those of Stetson and Sandia. Application to the case of silicon resins and carbon-carbon composites is detailed. ESA

N78-11360# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
INTERACTION BETWEEN A WAKE AND A BOUNDARY LAYER WITH A SOPHISTICATED TURBULENCE MODEL [PROBLEMES DE CONFLUENCE SILLAGE COUCHE LIMITE A L'AIDE D'UN MODELE ELABORE DE TURBULENCE]
J. C. Courty Paris Assoc. Aeron. et Astronautique de France 1977 39 p refs In FRENCH Presented at the 13th Colloq. d'Aerodyn. Appl., Lyon, 8-10 Nov. 1976
(AAAF-NT-77-12; ISBN-2-7170-0429-7) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 25 (France and EEC) FF 29 (others)

A review of methods for calculating the interaction between a wake and turbulent boundary layer is presented. Five such models have been used to compare their results to the Modane wing. A sixth method based on use of the spectrum space through the use of Fourier transforms is shown to go beyond the Boussinesq and to be applicable whenever the spectral equilibrium is not severely perturbed. ESA

N78-11361# Ecole Nationale Superieure de Techniques Avancees, Paris (France).
METHOD FOR DEVELOPING THE INFLUENCE FUNCTIONS OF NAVAL TRANSIENT HYDRODYNAMICS [METHODE POUR LE DEVELOPPEMENT DES FONCTIONS D'INFLUENCE DE L'HYDRODYNAMIQUE NAVALE INSTATIONNAIRE]
A. Jami Feb. 1977 52 p refs In FRENCH
(Rept-079) Avail: NTIS HC A03/MF A01

The basic problem of naval transient hydrodynamics is considered using the influence function. The actual calculation of the function is numerically difficult. Asymptotic methods for integrals having a large parameter in factor with the argument of an exponential function compensors with numerical examples are given. ESA

N78-11362# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
WINGS IN TRANSONIC FLOW. A POTENTIAL FLOW METHOD FOR DESIGN AND ANALYSIS AND A METHOD FOR THREE-DIMENSIONAL BOUNDARY LAYER CALCULATION
S. G. Hedman, H.-W. Stock, W. Fritz, and W. Schmidt 1976 109 p refs In GERMAN; ENGLISH summary Sponsored in part by Ger. Min. of Defence
(Contract FMV-F-INK-82223-74-001-07-001)
(FFA-AU-1231-Pt-1) Avail: NTIS HC A06/MF A01

An existing relaxation procedure for the calculation of transonic flow fields on given wing body combinations was revised and extended to include the capability for the design of wings. The computer program can handle analysis or design as well as mixed problems. The program was improved with respect to computer storage and time requirements and prepared to operate together with a boundary layer program. It was modified to include the shock point operator. For calculation of boundary layer displacement thickness an integral method for calculating characteristics of turbulent, three-dimensional compressible boundary layers was developed. The program applies to flows over wings and is made to match the transonic potential flow program. Comparison between results obtained with the two programs and results from experiments shows that these calculation procedures are powerful tools for the design and analysis of wing body configurations. Author (ESA)

N78-11363# National Aerospace Lab., Amsterdam (Netherlands). Flight Dynamics Div.
THE COOLING OF A POD-MOUNTED AVIONIC SYSTEM
I. DeBoer 22 Mar. 1976 7 p Presented at the AGARD Avionics Panel Spec. Meeting, The Hague, 10-11 Jun. 1976
(NLR-MP-76006-U) Avail: NTIS HC A02/MF A01

The principles and testing of the air cooling of the pod-mounted Orpheus day and night aerial reconnaissance system, since 1974 operational with the Royal Netherlands Air Force are described. The pod conditioning system was developed by pod manufacturer, Fokker-VFW, and flight-tested by the National Aerospace Laboratory NLR. At moderate airspeeds (e.g. 400 kts), with ram air temperatures up to 44 C, cooling is provided by ambient air entering the pod through a flush air intake in the nose and leaving it through slots in the pod belly. In low level flight at high subsonic speeds (e.g. 600 kts), with ram air temperatures up to 79 C, the cooling air temperature is kept below 50 C by spraying an automatically controlled amount of water into the airflow near the intake. During the flight testing of a pre-production reconnaissance system, unexpected cooling problems were encountered. These problems, not experienced during previous prototype tests, could be shown to originate in the NACA flush air intake. By changing to a flush air intake with parallel side walls, the cooling system could be made to perform to entire satisfaction in the series. Author (ESA)

N78-11364# Stuttgart Univ. (West Germany). Energy Conversion and Heat Transfer Div.
DESIGN AND DEVELOPMENT OF A HEAT PIPE DIODE. PHASE 1: DESIGN Final Report
M. Groll, Principal Investigator and W. D. Muenzel, Principal Investigator Paris ESA Jul. 1977 157 p refs
(Contract ESTEC-2993/76-NL-PP(SC))
(ESA-CR(P)-979) Avail: NTIS HC A08/MF A01

The analysis and design of a heat pipe thermal diode is described. The state-of-the-art of heat pipe technology, especially heat pipe diode technology, are reviewed. A number of design concepts is defined and subjected to a preliminary analysis. As a result of the evaluation and comparison of the various design concepts an all-aluminum axial groove/ammonia diode heat pipe employing the liquid trap principle was selected. A zero-g forward-mode maximum performance of the diode wick of 194 W was predicted at an operating temperature of 20 C. This corresponds to a heat transport capability of 5820 Wcm. The predicted reverse-mode conductance for completely shutdown diode at a temperature difference between normal condenser section and normal evaporator/trap section of 40 K is 0.0286, W/K. The shutdown ratio was calculated to be 384. Instrumentation and test setup as well as test procedures to experimentally determine forward and reverse-mode behavior of the heat pipe diode are described; a detailed manufacturing and assembly plan was developed. Author (ESA)

N78-11365# Engins Matra, Velizy (France).
DEVELOPMENT OF A COMPUTER SYSTEM FOR THE CALCULATION AND MANAGEMENT OF THERMAL MATHEMATICAL MODELS Final Report
J. F. Arnoult Paris ESA 18 May 1977 198 p refs
(Contract ESTEC-2845-NL-PP(SC))
(N-40-711-0; ESA-CR(P)-981) Avail: NTIS HC A09/MF A01

A detailed definition of a computer system for the calculation and the management of thermal mathematical models is given. A survey is presented of the available programs used to compute view factors, radiative interchanges, and/or incident heat fluxes. Methods are described for calculation or duplication of radiative and conductive conductances to obtain a complete data set of accurate conductances while saving computer time. A description is given of all the operations to be performed in order to obtain a complete and well documented thermal mathematical model by generation, modification of a previous one, or concatenation of several models. The use of a preprocessor concept is discussed. Author (ESA)

N78-11366# European Space Research and Technology Center, Noordwijk (Netherlands).
MICROSCOPIC EXAMINATION OF THE BEHAVIOR OF NON-CONDUCTIVE OPTICAL SOLAR REFLECTORS AFTER ELECTRICAL BREAKDOWN
C. E. Minier Paris ESA Sep. 1977 26 p refs
(ESA-TM-172) Avail: NTIS HC A03/MF A01

Nine nonconductive optical solar reflectors (OSR) were subjected to microscopic examination after irradiation with low-energy electrons (15 to 20 keV). Defects were found and closely studied. Subsequently, attempts were made to create similar defects in the laboratory so that the process could be fully understood and an explanation for it provided. An OSR panel with a nonconductive adhesive presents risks of depadation which can be detrimental to the thermal equilibrium in a spacecraft. The use of conductive adhesives to avoid such hazards needs to be examined. Author (ESA)

N78-11367# Bristol Univ. (England). Dept. of Mechanical Engineering.
THE PENETRATION OF MULTIPLE JETS IN A CROSSFLOW B.S. Thesis
P. K. Bailey and J. R. Evans Jun. 1977 46 p refs
(BU-77/A.1) Avail: NTIS HC A03/MF A01

The flow of air issuing from a transverse row of closely spaced identical orifices into a crossflow flowing normally to the issuing jets was examined. The pitch of the jets and the velocity of the crossflow were the principal variables. The jet spacing was varied between 1.3 and 6.5 orifice diameters, and the jet momentum ratio was varied between 3 and 15. Jet velocity and air temperature were kept nominally constant. Velocities were measured using a hot wire anemometer. An attempt was made to fit an empirical relation to the jet trajectories and the jet penetration in terms of momentum ratio and jet spacing. It was found that jet penetration increases with momentum ratio for fixed jet spacing, and that penetration decreases with jet spacing at first, reaches a minimum at a jet spacing of approximately 4 diameters, and thereafter increases for fixed momentum ratio. The tendency for recirculation to occur

decreases with jet spacing and increases with momentum ratio. These results are in agreement with the experiment undertaken on a smaller scale. The best empirical relation was of the form suggested by Pratte and Baines whose experiments were concerned only with a single jet. Author (ESA)

N78-11971# European Space Agency, Paris (France).
EXPERIMENTAL ANALYSIS OF THE CHARACTERISTICS OF A TURBULENT BOUNDARY LAYER IN A PULSATING FLOW. AN ATTEMPT AT THEORETICAL PREDICTION
Robert Houdeville, Andre Desopper, and Jean Cousteix *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-4 (ESA-TT-396) Jul. 1977 p 1-20 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-4, Jul.-Aug. 1976 p 183-191 Original report in FRENCH previously announced as A77-11156 (For availability see N78-11970 02-99)
Avail: NTIS HC A08/MF A01

N78-11978 European Space Agency, Paris (France).
BOUNDARY LAYER STUDY BY HOT FILM DETECTORS IN SUBSONIC AND TRANSONIC FLOW
Claude Armand *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-3 (ESA-TT-356) Nov. 1976 p 1-16 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-3, May - Jun. 1976 p 127-133 (For availability see N78-11977 02-99)
Avail: NTIS HC A07/MF A01

N78-11979# European Space Agency, Paris (France).
AEROTHERMAL STUDY OF THE FLOW THROUGH A DUCT WITH PERFORATED WALLS
Emile LeGrives and Jeanne Genot *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-3 (ESA-TT-356) Nov. 1976 p 17-49 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-3, May - Jun. 1976 p 135-147 Original report in FRENCH previously announced as A76-41126 (For availability see N78-11977 02-99)
Avail: NTIS HC A07/MF A01

N78-11985# European Space Agency, Paris (France).
AN INTEGRAL METHOD FOR THE CALCULATION OF A TURBULENT BOUNDARY LAYER ALONG A LONGITUDINALLY CURVED WALL
Jean Cousteix and Robert Houdeville *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-1 (ESA-TT-407) Sep. 1977 p 1-32 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-1, Jan.-Feb. 1977 p 1-13 Original report in FRENCH previously announced as A77-27740 (For availability see N78-11984 02-99)
Avail: NTIS HC A07/MF A01

N78-11986# European Space Agency, Paris (France).
RECIRCULATION BUBBLES IN THE CORE OF A WAKE
Henri Werle and Jean-Louis Solignac *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-1 (ESA-TT-407) Sep. 1977 p 33-60 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-1, Jan.-Feb. 1977 p 15-30 Original report in FRENCH previously announced as A77-27741 (For availability see N78-11984 02-99)
Avail: NTIS HC A07/MF A01

N78-11993# European Space Agency, Paris (France).
EXPERIMENTAL AND THEORETICAL STUDY OF BOUNDARY LAYER TRANSITION
Daniel Arnal and Jean-Claude Juillen *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-2 (ESA-TT-408) Sep. 1977 p 26-63 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-2, Mar. - Apr. 1977 p 75-88 Original report in FRENCH previously announced as A77-28927 (For availability see N78-11991 02-99)
Avail: NTIS HC A09/MF A01

N78-11997# European Space Agency, Paris (France).
COMPLEXITY OF THE ROLE OF COMPRESSIBILITY IN FLUID MECHANICS
Robert Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-2 (ESA-TT-408) Sep. 1977 p 158-164 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-2, Mar. - Apr. 1977 p 127-128 Original report in FRENCH previously announced as A77-32948 (For availability see N78-11991 02-99)
Avail: NTIS HC A09/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N78-11368*# Teledyne Systems Co., Northridge, Calif.
STRAPDOWN GYRO TEST PROGRAM Final Report, 1 Jun. 1976 - 1 Sep. 1977
R. B. Irvine and R. VanAlstine Oct. 1977 59 p refs
(Contract NAS3-31909)
(NASA-CR-150458) Avail: NTIS HC A04/MF A01 CSCL 14B

The power spectral noise characteristic performance of the Teledyne two-degree-of-freedom dry tuned gimbal gyroscope was determined. Tests were conducted using a current configuration SDG-5 gyro in conjunction with test equipment with minor modification. Long term bias stability tests were conducted as well as some first difference performance tests. The gyro, test equipment, and the tests performed are described. Results are presented. Author

N78-11369*# Texas A&M Univ., College Station. Inst. for Solid State Electronics.
CAMERAS FOR SEMICONDUCTOR PROCESS CONTROL Final Report
W. A. Porter and D. L. Parker Aug. 1977 51 p
(Contract NAS8-26379)
(NASA-CR-150459) Avail: NTIS HC A04/MF A01 CSCL 14E

The application of X-ray topography to semiconductor process control is described, considering the novel features of the high speed camera and the difficulties associated with this technique. The most significant results on the effects of material defects on device performance are presented, including results obtained using wafers processed entirely within this institute. Defects were identified using the X-ray camera and correlations made with probe data. Also included are temperature dependent effects of material defects. Recent applications and improvements of X-ray topographs of silicon-on-sapphire and gallium arsenide are presented with a description of a real time TV system prototype and of the most recent vacuum chuck design. Discussion is included of our promotion of the use of the camera by various semiconductor manufacturers. Author

N78-11370*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ELECTRICALLY SCANNED PRESSURE SENSOR MODULE WITH IN SITU CALIBRATION CAPABILITY Patent Application
Chris Gross, inventor (to NASA) Filed 22 Sep. 1977 17 p
(NASA-Case-LAR-12230-1; US-Patent-Appl-SN-835628) Avail: NTIS HC A02/MF A01 CSCL 14B

A high data rate pressure sensor module with an in situ calibration capability to help reduce energy consumption in wind tunnel facilities without loss of measurement accuracy is described. The sensor module allows for nearly a two order of magnitude increase in data rates over conventional electromechanically scanned pressure sampling techniques. The module consists of 16 solid state pressure sensor chips and signal multiplexing electronics integrally mounted to a four position pressure selector switch. One of the four positions of the pressure selector switch allows the in situ calibration of the 16 pressure sensors; the three other positions allow 48 channels (three sets of 16) pressure inputs to be measured by the sensors. The small size of the sensor module allows mounting within many wind tunnel

models, thus eliminating long tube lengths and their corresponding slow pressure response. NASA

N78-11371*# RCA Astro-Electronics Div., Princeton, N. J.
RETURN BEAM VIDICON (RBV) PANCHROMATIC TWO-CAMERA SUBSYSTEM FOR LANDSAT-C Final Report
17 Jun. 1977 189 p refs
(Contract NAS5-22350)
(NASA-CR-156639; AE-R-4231) Avail: NTIS HC A09/MF A01 CSCL 14E

A two-inch Return Beam Vidicon (RBV) panchromatic two camera Subsystem, together with spare components was designed and fabricated for the LANDSAT-C Satellite; the basis for the design was the Landsat 1&2 RBV Camera System. The purpose of the RBV Subsystem is to acquire high resolution pictures of the Earth for a mapping application. Where possible, residual LANDSAT 1 and 2 equipment was utilized. Author

N78-11372# Materials Research Labs., Maribyrnong (Australia).
CALIBRATION OF GRATICULES TO HIGH ACCURACY
D. B. Prowse Mar. 1977 13 p refs
(AD-A042566; MRL-TN-394) Avail: NTIS HC A02/MF A01 CSCL 14/2

A technique for calibrating graticules (or stage micrometers) to high accuracy (+ or - 0.1 micrometers) is described. The lines were sensed photo-electrically and the distance between lines was measured with a laser interferometer. The accuracy is limited mainly by the quality of the graticule lines but for a graticule with long well-defined lines the uncertainty of measurement was 0.04 micrometers. Author (GRA)

N78-11373# Harry Diamond Labs., Adelphi, Md.
ARMS REMOTE USER'S MANUAL
David J. Buscher and Marc A. Ressler Dec. 1976 26 p refs
(AD-A043049; HDL-SR-76-3) Avail: NTIS HC A03/MF A01 CSCL 14/2

This manual explains the operation of the Automatic Revenue Metering System Remote Prototype, commonly called the ARMS Remote or simply Remote. The ARMS Remote interfaces existing power meters to an automated revenue metering system. The Remote is contained in a single 24-in. (610-mm) rack-mounted panel. It consists of power supplies, a processor module, input/output (I/O) modules, a timing module, a tape cartridge recorder, a keypad, a 16-character alphanumeric display, status display lights, telemetry interface and tone equipment, a series of system test points, and I/O connectors to attach the Remote to the environment that it will monitor. This report discusses normal operation of the ARMS Remote from the user's viewpoint and describes all the steps required for successful use of the system. Since no ARMS Master Station exists at this time, all Master Station functions will be performed locally via Teletype or Remote keypad. However, for understanding of the complete ARMS Remote/Master Station concept, Master Station functions are identified where possible. Information is included for the use of the local Teletype and keypad for Master Station actions. Author (GRA)

N78-11374# Physics International Co., San Leandro, Calif.
IN SITU STRESS GAUGE CALIBRATION Final Report, Sep. 1974 - Feb. 1977
K. Seifert and J. Shea May 1977 60 p refs
(Contract DNA001-75-C-0020)
(AD-A043906; PIFR-755; DNA-425F) Avail: NTIS HC A06/MF A01 CSCL 19/4

The accuracy of 'in situ' stress measurements is dependent upon the presence of strain within the active gauge element. In gauge records of dynamic stress fields, the onset of strain response of the gauge is not able to be defined. Development of a gauge that responds only to the applied pressure, independent of the strain field, is usable in that the deviance of a stress transducer from its calibration in a dynamic field can be observed by comparison to the pressure indicated by the calibration gauge. Through the use of variations in resistance or dielectric constant that accompany phase transitions, calibration gauges can be constructed for use in 'in situ' calibration of stress transducers. The program conducted investigated various materials as candidates for phase transition gauges, including bismuth metal, bismuth/lead alloy (75:25% by weight), thallium/indium alloy, (77:23%). Gas-gun experiments and explosive plane wave lens experiments were conducted during the program with confirmation of the dynamic response of the phase transition; however, accurate determination of the pressure associated with the phase transition and the duration required for the transition to take place was not accomplished. Author (GRA)

N78-11375# Technische Physische Dienst TNO-TH, Delft (Netherlands).
HIGH ACCURACY SUN SENSOR - PHASE 1A AND 1B Final Report
A. Hammerschlag, C. W. deBoom, and H. Bokhove Paris ESA 18 Aug. 1977 184 p refs
(Contract ESTEC-2846/76-NL-AK(SC))
(TPD-611.257; ESA-CR(P)-983) Avail: NTIS HC A09/MF A01

Work is reported on a system definition of a high accuracy sun sensor for a spaceborne instrument pointing system to be applied in solar research. Several principles on which the sensor could be based were investigated and compared: a collimator approach with slit aperture, an interferometric solution with two apertures, and an imaging system with a CCD detector at focus. The sensitivity to irregular features of the sun played an important role in selecting the preferred concept. Final tradeoff resulted in selection of the collimator in combination with a linear CCD detector. The performance of this system was analyzed, resulting in the assessment of an error budget, the sensor's physical parameters, and its reliability. The aspect of calibration was also considered. ESA

N78-11376# Battelle Inst., Frankfurt am Main (West Germany).
SURVEY AND ASSESSMENT OF ACCELEROMETERS FOR POTENTIAL USE IN SPACELAB MATERIAL SCIENCE PAYLOADS Final Report
Paris ESA Aug. 1977 33 p refs
(Contract ESTEC-2999/76-NL-PP(SC))
(BF-R-63.289-01; ESA-CR(P)-988) Avail: NTIS HC A03/MF A01

Instrumentation for monitoring residual acceleration levels during materials science experiments onboard Spacelab was investigated. A market survey including a short phenomenological study was performed to provide the necessary information. Taking into consideration the desired conditions for reliability, accuracy, and environmental compatibility, three possible accelerometers were selected. The first choice, which is superior to all others, is the Systron-Donner 4841 + or - 10 m g accelerometer, a proven instrument which can be used without any modification. The second and third systems selected are the Sagem A 42 and the Ferranti FA 2F accelerometers, which can be used only after appropriate range modifications. Author (ESA)

N78-11673*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INSTRUMENTATION FOR SPACE FLIGHT EXPERIMENTS
Ernest P. McCutcheon *In its* The Use of Nonhuman Primates in Space Sep. 1977 p 225-243 refs (For availability see N78-11663 02-51)
Avail: NTIS HC A17/MF A01 CSCL 14B

N78-11940# Commissariat a l'Energie Atomique, Saclay (France).
RECENT MEASUREMENTS WITH A BALLOON-BORNE Ge(Li) SPECTROMETER IN GAMMA-RAY ASTRONOMY
D. Boclet, J. Claisse, P. Durouchoux, E. Olivier, P. Pagnier, R. Rocchia, F. Albernhe (Centre d'Etudes Spatiales des Rayonnements), M. Frabel (Centre d'Etudes Spatiales des Rayonnements), G. Vedrenne (Centre d'Etudes Spatiales des Rayonnements), and J. Marques (Inst. des Pesquisas Espacias, Sao Paolo, Brazil) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 293-299 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11944# Consiglio Nazionale delle Ricerche, Bologna (Italy). Lab. TESRE.
THE LIMITS OF NON-DIRECTIONAL DETECTORS: DIFFUSE BACKGROUND AND ANISOTROPY MEASUREMENTS
G. Cavallo, H. M. Horstman, and E. Moretti-Horstman *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 323-325

refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11946# Consiglio Nazionale delle Ricerche, Bologna (Italy). Lab. TESRE.
PRELIMINARY APPLICATION OF A NEW METHOD FOR THE ANALYSIS OF BALLOON-BORNE DIFFUSE BACKGROUND MEASUREMENTS
E. Moretti-Horstman and H. M. Horstman *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 339-342 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11948# Center for Astrophysics, Cambridge, Mass.
CODED DEPARTURE DETECTOR FOR HIGH PRECISION GAMMA-RAY BURST SOURCE LOCATIONS
H. Helmken and P. Gorenstein *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 353-359 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11949# Consiglio Nazionale delle Ricerche, Bologna (Italy). Lab. TESRE.
GAMMA-RAY BURST FREQUENCY AS SEEN BY BALLOON-BORNE DETECTORS
H. M. Horstman, L. Bassani (Bologna Univ.), and E. Moretti-Horstman *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 361-363 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N78-11377 Kentucky Univ., Lexington.
TWO-STATE AND TWO-STATE PLUS CONTINUUM PROBLEMS ASSOCIATED WITH THE INTERACTION OF INTENSE LASER PULSES WITH ATOMS Ph.D. Thesis
Chang Whan Choi 1977 117 p
Avail: Univ. Microfilms Order No. 77-15939

Two mathematical methods (one a form of adiabatic approximation, and the other closely related to the Zener method from collision theory) were utilized to calculate the probability of three-photon ionization when strong counter propagating pulses are tuned very near a two-photon resonant state. A sharp onset in the ionization probability occurs as the lasers are tuned through the exact unperturbed two-photon resonance. Under proper conditions, the change can be from a very small value to one near unity. It occurs in a very small frequency range determined by the larger of the residual Doppler effect and the reciprocal duration of the pulse. The same mathematical methods have been used to calculate line shapes for the two-photon excitation of fluorescence when the atoms see a pulsed field due to their time of passage across a tightly focused C.W. laser beam. Thus, the mathematical methods used above permitted accurate analytical calculations under a set of very interesting conditions.
Dissert. Abstr.

N78-11378*# Maryland Univ., College Park. Inst. for Physical Science and Technology.
TUNABLE LASERS FOR WATER VAPOR MEASUREMENTS AND OTHER LIDAR APPLICATIONS
R. W. Gammon, T. J. McIlrath, and T. D. Wilkerson Oct. 1977 28 p ref
(Grant NsG-1156)
(NASA-CR-155228; TN-BN-866) Avail: NTIS HC A03/MF A01 CSCL 20E

A tunable dye laser suitable for differential absorption (DIAL) measurements of water vapor in the troposphere was constructed. A multi-pass absorption cell for calibration was also constructed for use in atmospheric DIAL measurements of water vapor.
Author

N78-11379# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
AN ANNULAR IODINE LASER FACILITY Interim Report
Eugene B. Turner, Richard A. Chodzko, and Rolf W. F. Gross 15 Jun. 1977 44 p refs
(Contract F04701-76-C-0077)
(AD-A042282; TR-0077(2605)-2; SAMSO-TR-77-108) Avail: NTIS HC A03/MF A01 CSCL 20/5

The design and performance of an annular iodine laser built to study annular resonators at a large Fresnel number are described. A high-intensity axial flashlamp is used to dissociate C3F7I vapor in the annular lasing region. The excited iodine atoms resulting from this dissociation produce radiation of 1.315 micrometer wavelength by stimulated transition to the ground state. The pulsed energy output of 12.5 J was close to the performance estimates, which also indicated a small signal gain of 6.2 per meter, required for saturation of the medium, and which could be obtained. The details of the high-voltage capacitor discharge circuit, the vacuum and gas handling system, and the laser tube fabrication are described.
Author (GRA)

N78-11380# RCA Government and Commercial Systems, Burlington, Mass. Automated Systems.
RANGEFINDER, LASER AN/GVS-5( ) Final Report, Jul. 1974 - Jul. 1976
J. Woodward and S. Waldstein Fort Monmouth, N. J. ECOM Jun. 1977 367 p
(Contract DAAB07-74-C-0270; DA Proj. 1E7-6423-DI-71)
(AD-A042502; ECOM-0270-F) Avail: NTIS HC A16/MF A01 CSCL 17/5

This AN/GVS-5 V Final Technical Report documents the two years of effort expended by RCA Corporation for the United States Army Electronics Command. This report describes effort which occurred subsequent to submission of the Design Plan which detailed the analytical effort, breadboarding and planned tests. This report makes frequent references to the Design Plan and describes the differences in the final product. Pertinent excerpts from the design Plan, which are referenced in this report, are included in Appendix A of this report. The principal items discussed are: (1) Hand Held Laser Rangefinder; (2) Special Jest Equipment; and (3) Azimuth - Elevation Head and Tripod. The performance characteristics or typical parameters are shown to meet the requirements of the development specification. Detailed definition of the hardware is fully documented in drawing sets. The results of performance and environmental tests are presented in detail, and finally, changes are recommended for future consideration.
Author GRA

N78-11381# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.
ANHARMONIC OSCILLATOR LASERS Final Progress Report
J. A. Smith, S. H. Lam, G. K. Bienkowski, and R. B. Miles Jul. 1977 130 p refs
(Contract F44620-73-C-0059)
(AD-A043184; AFOSR-77-0956TR) Avail: NTIS HC A07/MF A01 CSCL 20/5

Emphasis of the work performed under this contract has been placed on fundamental theoretical and experimental studies of various phenomena associated with diatomic molecular gas flows in which anharmonicity plays an important role in producing or maintaining an inversion which is suitable for lasing. Most of the work concerned carbon monoxide gas dynamic or electrically excited flows because these systems were capable of being studied in our laboratories, had considerable potential practical importance, and displayed many characteristics common to other diatomic gas lasers. In several cases the results may be generalized to other systems. Study of the master kinetic equations demonstrated that approximate analytical solutions exist under certain conditions. It is shown that quantitative prediction of the vibrational population distribution can be determined from knowledge of just a few key parameters in many cases of practical interest. The experimental measurement of small signal gains in highly expanded CO-N2 mixtures confirmed the anticipated large gains achievable at very low temperatures. However, unexpected rotational nonequilibrium was observed which can limit the power available from P branch laser lines. A summary of efforts to provide a simplified method of computing vibrational excitation rates in a discharge is presented. A modified E/N parameter

was established which is shown to correlate results determined in a variety of gas mixtures. An experimental study of a double discharge excitation scheme in a supersonic CO-N2 flow disclosed that the secondary pin discharge is not capable of providing a stable discharge with independently controlled E/N under the conditions tested. GRA

N78-11382# Owens-Illinois, Inc., Toledo, Ohio. Corporate Technology Div.
INVESTIGATION OF BROAD-BAND EMITTERS AS POTENTIAL LASING IONS BETWEEN 0.5 AND 1.0 MICROMETERS Interim Report, 1 Jun. 1976 - 31 May 1977
Charles F. Rapp, N. L. Boling, and Cloyce M. Carlen Jul. 1977 61 p refs
(Contract F44620-76-C-0088; AF Proj. 2301)
(AD-A043185; AFOSR-77-0959TR) Avail: NTIS HC A04/MF A01 CSCL 20/5

Although fluorescent ions in glass were studied extensively during the 1960's for possible lasing action, these studies were primarily restricted to narrow emission band, long decay time ions such as the trivalent rare earths. This restriction was necessitated by the limited power of the then available flashlamps. The development of powerful, short pulse flashlamps for dye layers in recent years has removed this constraint and now makes it feasible to consider broad-band emitters in glasses and crystals for lasing action. As opposed to the trivalent rare earths, which generally have their strongest fluorescent lines in the near IR, broad-band emitters offer the possibility of visible and near UV lasers. Tuning over wide frequency ranges is also a possibility. In this study, interest was primarily directed towards ions emitting in or near the spectral region between 0.5 micrometer and 1.0 micrometer. GRA

N78-11383# Naval Research Lab., Washington, D. C.
ENHANCED BACKSCATTER WITH A STRUCTURED LASER PULSE
B. H. Ripin, F. C. Young, J. A. Stamper, C. M. Armstrong, and R. Decoster Jul. 1977 17 p refs
(AD-A043123; NRL-MR-3560) Avail: NTIS HC A02/MF A01 CSCL 20/5

A large amplitude backscatter instability, consistent with Brillouin, occurs when a prepulse plasma is formed ahead of a high irradiance (10 to the 15th to 10 to the 16th power W/sq cm) Nd-laser pulse. These results indicate that temporally structured laser pulses suggested for laser pellet implosion may also encounter large backscatter. Author (GRA)

N78-11384# Wisconsin Univ., Madison. Dept. of Chemistry.
MOLECULAR ELECTRONIC PHOTODISSOCIATION LASER STUDIES Final Scientific Report, 1 Feb. 1974 - 31 Jan. 1976
Michael J. Berry Jul. 1977 17 p
(Grant AF-AFOSR-2666-74)
(AD-A043224) Avail: NTIS HC A02/MF A01 CSCL 20/5

Chemical laser experimental techniques were used to analyze features of energy partitioning and electronic branching in photochemical and bimolecular chemical reactions. Accurate population inversions were determined for two classes of reactions: (1) photodissociation (e.g., photodissociative excitation of cyanide radical by photolysis of CH3NC) and (2) bimolecular exchange (e.g., F - HI yields HF(v)-I). New lasing transitions of the cyanide radical molecular electronic laser were obtained. In addition, energy redistribution processes were examined in the cyanide radical laser system. GRA

N78-11385# Ballistic Research Labs., Aberdeen Proving Ground, Md.
PHOTODISSOCIATION OF NO(+)(NO) AND NO(+)(H2O) Final Report
J. A. Vanderhoff Jul. 1977 27 p refs
(AD-A043272; BRL-1994) Avail: NTIS HC A03/MF A01 CSCL 20/8

A drift tube mass spectrometer coupled with ion laser and ion laser pumped tunable dye laser photon sources has been used to measure the thermal energy (300K) photodissociation cross sections for two positive ion clusters, nitric oxide clustered with the nitric oxide ion and water clustered with the nitric oxide ion. Measurements were made spanning a photon wavelength range from 799 to 350 nm. The absolute photodissociation cross sections for nitric oxide clustered with the nitric oxide ion were found to vary smoothly with photon wavelength attaining a maximum value of 2 x 10(-17) square centimeters at approx. 650 nm decreasing at both longer and shorter wavelengths. In addition, coupling of clustering reactions into the photodissociation cross section appeared under a variety of conditions. Photodissociation cross sections for water clustering with the nitric oxide ion were found to be small or zero. Upper limits of approx. 1 x 10(-19) square centimeters were obtained for these cross sections. GRA

N78-11386# Systems Research Labs., Inc., Dayton, Ohio. Research Applications Div.
ELECTRO-AERODYNAMIC LASER-BEAM-PARAMETER MEASUREMENT Interim Report, Jan. - Jul. 1976
Robert A. Olson, D. F. Grosjean, and B. Sarka, Jr. Sep. 1976 22 p refs
(Contract F33615-74-D-0473)
(AD-A043303; SRL-7615; AFAPL-TR-76-84) Avail: NTIS HC A02/MF A01 CSCL 20/5

A diagnostic system to measure the beam power and quality of the Air Force Aero Propulsion Laboratory 15-kW CO2 electro-aerodynamic laser has been designed, fabricated, and tested. An anti-reflection-coated ZnSe beam splitter was employed to split off a small fraction (0.5%) of the main laser beam for diagnostic purposes. The low-power beam was split again to provide two beams for power and energy-distribution measurements, concurrent with sample irradiation by the main beam. An electrically calibrated disc calorimeter was used to measure beam power. The temporal and spatial energy distributions were measured by means of a mechanically scanned, one-dimensional pyrolytic array. This provided a 16 x 16-element two-dimensional map of the beam profile at a rate of up to 10 Hz. High-speed data acquisition was accomplished by transmitting the digital data to a PDP-8A minicomputer system (located in a central control room) configured for tape-cassette mass storage and hard-copy plotting. Initial experimental spatial/temporal beam-energy distributions obtained with this system have demonstrated the efficacy of this beam-profiling technique.
Author (GRA)

N78-11387# Honeywell Corporate Research Center, Bloomington, Minn.
INVESTIGATION OF MATERIAL DAMAGE Interim Report, 15 Dec. 1975 - 14 Dec. 1976
John F. Ready Feb. 1977 55 p refs
(Contract F44620-73-C-0022)
(AD-A043437; AFOSR-77-1001TR) Avail: NTIS HC A04/MF A01 CSCL 20/5

This report describes work performed in a continuing program of investigations on the mechanisms by which high power pulsed CO2 laser radiation interacts with target surfaces. The experimental work has been performed using a pulsed CO2 TEA laser capable of delivering up to ten to the 9th power w/sq cm to the target surface in a pulse of duration around 100 nanoseconds. Results described in this report include the following: (1) Measurement of the pressure pulse induced in target materials by the laser pulse. Measurements were obtained as a function of target material, thickness, ambient air pressure, laser power density, and interpulse time. For metals, a typical value of peak shock pressure is around 100 bars at a laser power density around 1.5 x ten to the 8th power/sq cm at 1 atmosphere ambient pressure. For alkali halides, the results can be related to material damage. (2) Characterization of the target surface, by Auger spectroscopy and by measurements of surface scattering to determine the spectral density function. (3) Determination of the fraction of laser energy coupled into the blowoff material as a function of laser power density. (4) Construction of apparatus to determine total reflectivity as a function of time during the laser interaction. Author (GRA)

N78-11388# Wayne State Univ., Detroit, Mich. Research Inst. for Engineering Sciences.
ENERGY TRANSFER IN LASERS Final Report
Edward R. Fisher and Allan J. Lightman Jun. 1977 110 p refs
(Contract N00014-75-C-0284)

(AD-A043808) Avail: NTIS HC A06/MF A01 CSCL 20/5

This final report details plasma-chemical and energy transfer studies carried out at the RIES. Experimental and analytical research has been aimed at understanding additive effects in discharge supported molecular laser systems, particularly the CO laser system. Extensive numerical model codes have been developed and applied to the CO system with considerable success. Experiments in the laboratories have provided important information on high lying vibrational states in CO, in agreement with model predictions. Collaborative studies between RIES and Princeton University on the behavior of vibrational distributions under strongly pumped conditions are outlined. Author (GRA)

N78-11389# Perkin-Elmer Corp., Norwalk, Conn. Electro-Optical Div.

TORIC RESONATOR EXPERIMENTAL STUDY Final Report

Jul. 1977 135 p refs

(Contract F29601-75-C-0141)

(AD-A043523; AFWL-TR-76-327) Avail: NTIS HC A07/MF A01 CSCL 20/5

An experimental study of several unstable resonator concepts for annular gain volume lasers has been performed. The annular geometry is potentially advantageous for lasers employing radial flow of gain media across the optical resonator axis. The objectives of this study were to determine the ability of each resonator concept to support a single low-order transverse mode, and to measure its sensitivity to various misalignments and figure errors. The configurations tested were the 'converging' wave resonator of Chodzko, and several variations of the half-symmetric unstable resonator with an intracavity axicon (HSURIA). Several different annular gain cells were designed and used in these test including an annular dye cell (visible) and a flash photolysis DF (IR) gain cell, each stimulated by a central flash lamp. The 'converging wave' resonator did not produce the desired single low order transverse mode and its characteristics were sensitive to small misalignments (approximately 10 micro rad). Results obtained for the HSURIA show evidence of fundamental mode output (less than or equal to 2 lambda/D divergence) and high sensitivity to misalignments. Modification of the cavity with a hollow corner reflector in place of the spherical feedback mirror significantly reduces this misalignment sensitivity. Author (GRA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N78-11390 Illinois Univ., Urbana-Champaign.

ANALYSIS PROCEDURE FOR FRICTIONAL CONTACT PROBLEMS USING INTERFACE FINITE ELEMENTS Ph.D. Thesis

Jorge Luis Urzua 1977 160 p

Avail: Univ. Microfilms Order No. 77-15030

Isoparametric elements were used to model irregular geometries and interbody tractions on contact surfaces were incorporated as primary variables in a system developed for solving large and complex frictional contact problems, especially those involving truss-type bolted connections in three dimensions. The numerical procedure presented allows either incremental loading or iteration with total loads for those problems in which the solution is independent of applied load level, and accounts for frictionless as well as frictional contact. The results for several examples are presented and compared with experimental and analytical solutions. The comparisons indicate that geometrically more complex bolted connections can be handled with good accuracy. Dissert. Abstr.

N78-11391# Advisory Group for Aerospace Research and Development, Paris (France).

ADVANCED MANUFACTURING TECHNIQUES IN JOINING OF AEROSPACE MATERIALS

Sep. 1977 192 p refs

(AGARD-LS-91; ISBN-92-838-0203-5) Avail: NTIS HC A09/MF A01

A comprehensive survey is presented of joining processes and their application in aerospace industries, thus contributing to an exploitation of welding and similar processes in production technology. For individual titles, see N78-11392 through N78-11397.

N78-11392 Grumman Aerospace Corp., Bethpage, N.Y. Advanced Materials and Processes Development.

ADVANCED JOINING TECHNIQUES IN AEROSPACE CELL STRUCTURES

Robert H. Witt *In* AGARD Advanced Manufacturing Tech. in Joining of Aerospace Mater. Sep. 1977 29 p refs (For availability see N78-11391 02-37)

Avail: NTIS HC A09/MF A01

General aspects of advantages and difficulties in welding critical primary aircraft structures are discussed. The all-welded F-14A wing center-section is used as an example to delineate the types of problems inherent in selecting the optimum welding process and procedures to assure structural integrity, minimum cost, distortion control and light weight. The aerospace industry is particularly interested in joining titanium, steel and aluminum alloys in various gages ranging from thin sheet to heavy plate, 2 to 3 in. (50 to 75 mm) thick. Various welding processes and applications are discussed in relation to selection criteria. Developments in electron-beam welding small and large titanium structures are presented with particular attention given to high vacuum welding and directions being taken in non-vacuum and sliding-seal electron-beam welding. Applications of pulsed gas-tungsten-arc, plasma-arc (welding and cutting), laser beam (welding and cutting), weld-bonding, diffusion bonding, and brazing are discussed. The survey continues with a discussion of design for use of modern methods of weld inspection, the effects of defects on weld performance and some experiences in testing large structures. Recommendations for use of design and test data evaluations to minimize cost, increase ease of fabrication, facilitate inspection and increase reliability confidence conclude the paper. Author

N78-11393 Pratt and Whitney Aircraft Group, East Hartford, Conn. Materials Engineering and Research Lab.

PROCESS AND METALLURGICAL FACTORS IN JOINING SUPERALLOYS AND OTHER HIGH SERVICE TEMPERATURE MATERIALS

William A. Owczarski *In* AGARD Advanced Manufacturing Tech. in Joining of Aerospace Mater. Sep. 1977 32p refs (For availability see N78-11391 02-37)

Avail: NTIS HC A08/MF A01

Aircraft gas turbines rely on materials which must operate durably at elevated temperatures. Fabrication methods to make turbine parts are selected for reliability and cost effectiveness. Thus nickel-base superalloys, which are the dominant heat resistant material used in aircraft gas turbines, are frequently metallurgically joined in manufacture or repair of a gas turbine. The nature of the superalloy class of materials makes joining difficult. Several problems exist in welding the superalloys such as heat affected zone hot cracking and post-weld heat treatment cracking. The nature of these difficulties is described, including a metallurgical discussion of their causes. Methods for reducing or eliminating these problems are discussed along with some general guidelines for joining this material class. Some examples of the processes and applications for joining are reviewed along with descriptions of how processes are adapted to provide the quality, properties and reliability required for gas turbine use of welded superalloys. Author

N78-11394 Welding Inst., Cambridge (England).

RECENT DEVELOPMENTS IN WELDING TECHNOLOGY

R. Weck *In* AGARD Advanced Manufacturing Tech. in Joining of Aerospace Mater. Sep. 1977 19 p refs (For availability see N78-11391 02-37)

Avail: NTIS HC A09/MF A01

With the development of pulsed TIG and MIG welding and the universal transistorized power source the ultimate step in the development of fusion welding processes appears to have been taken. Despite the fact that high precision welding is now possible, requirements for quality and reliability have now become so stringent that the available techniques are no longer adequate to achieve them. There is, however, scope for improving the economics in the use of the processes. Solid phase welding processes, such as diffusion bonding and friction welding, are

largely free from the problems of the fusion welding processes but the research and development effort in these areas is minimal. International co-operation in welding technology, given the inherent difficulties of communication, is probably at least as good if not better than many other areas, particularly through the work of the International Institute of Welding. Progress in international standardization is slow for commercial and legal reasons and even within the European Community differing standards are a serious obstacle to the free interchange of techniques and equipment. Author

N78-11395 Dortmund Univ. (West Germany).
NON-WELDING JOINING, CUTTING AND THERMAL SPRAYING METHODS
H. D. Steffens *In* AGARD Advanced Manufacturing Tech. in Joining Aerospace Mater. Sep. 1977 25 p refs (For availability see N78-11391 02-37)
Avail: NTIS HC A09/MF A01

No heat at all will necessarily be used in metal or polymer bonding, where no restrictions are given in the selection of material to be joined. The short term low temperature properties of the joints are excellent when thermal resistivity is poor, but long term properties, especially under environmental conditions, are widely unknown. However, many examples are known for applied bonding joints in aerospace industries. Thermal cutting processes are used as preparation methods for metallic components prior to welding or other joining processes. Oxy-acetylene plasma arc and laser beam cutting offer certain advantages for particular materials and sheet thicknesses. There is a strong development in laser techniques by which cutting processes in aircraft industries will be affected. Author

N78-11396 Dortmund Univ. (West Germany).
ASPECTS OF THE MECHANICAL AND ENVIRONMENTAL BEHAVIOR OF JOINTS
H. A. Crostack *In* AGARD Advanced Manufacturing Tech. in Joining of Aerospace Mater. Sep. 1977 29 p refs (For availability see N78-11391 02-37)
Avail: NTIS HC A09/MF A01

The strength of structural components is often limited by the mechanical and environmental behavior of joints. The properties of the inhomogeneous parts are different from the behavior of the base materials. Inside the seam they depend on the heat-treatment and residual stresses. The basic principles of test methods such as fracture mechanics, fatigue tests and tests under environmental conditions are discussed. Applications are presented in some examples of TIG, EB and resistance weldments, high temperature brazements, and bonded structures. The detection of defects in joints in a nondestructive manner, as through application of holography and acoustic emission, is discussed and compared with conventional methods such as ultrasonic or X-Ray testing. Author

N78-11397 Societe Nationale Industrielle Aerospatiale, Paris (France).
WELDED METAL SANDWICH WITH CORRUGATED CORE: IMPROVEMENTS IN MECHANICAL STRENGTH CHARACTERISTICS BY RELAXATION-DIFFUSION HEAT TREATMENT, METHOD OF QUALITY CONTROL OF SPOT WELDS BY INFRA-RED THERMOGRAPHY
S. Dzalba-Lyndis *In* AGARD Advanced Manufacturing Tech. in Joining of Aerospace Mater. Sep. 1977 29 p In ENGLISH and FRENCH (For availability see N78-11391 02-37)
Avail: NTIS HC A09/MF A01

During the development of a sandwich material with a spot-resistance-welded corrugated core, two particular techniques were tried and evaluated. These techniques can be used for all other types of welded structures. The first technique, when titanium or titanium alloys are used, consists in subjecting the material, previously spot welded by the resistance method, to a heat treatment in vacuo, which ensures (1) metallurgical homogeneity between the base metal and the zones affected by the welding, (2) relaxation of the welding stresses, and (3) an increase in the bonding areas by solid state diffusion, under the hammered welding forces only. This process leads to considerable improvement in the fatigue and static mechanical strength of the material. The second technique is a method of quality control of welds during manufacture. It consists in observing the surface of the material a brief moment after the formation of a weld point by the use of an infra-red camera, associated with a TV monitor. The thermal signature of a weld point is closely related to its quality. Author

N78-11398*# National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD AND TURBINE FOR EXTRACTING KINETIC ENERGY FROM A STREAM OF TWO-PHASE FLUID Patent Application
David G. Elliott, inventor (to NASA) (JPL) Filed 31 Oct. 1977 20 p
(Contract NAS7-100)
(NASA-Case-NPO-14130-1; US-Patent-Appl-SN-847278) Avail: NTIS HC A02/MF A01 CSCL 13I

A turbine is described which comprises a plurality of nozzles for delivering streams of a two-phase fluid along linear paths and a phase separator for responsively separating the vapor and liquid phases. This phase separator is characterized by concentrically related annuli supported for rotation within the paths and having endless channels for confining the liquid under the influence of centrifugal forces. A vapor turbine fan extracts kinetic energy from the vapor, and a liquid turbine blade extracts kinetic energy from the liquid. Thus, the angular momentum of both the liquid phase and the vapor phase of the fluid is converted to torque. NASA

N78-11399*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
RECIPROCATING ENGINES Patent Application
James W. Akkerman, inventor (to NASA) Filed 31 Oct. 1977 17 p
(NASA-Case-MSC-16239-1; US-Patent-Appl-SN-847276) Avail: NTIS HC A02/MF A01 CSCL 20A

The operation of the intake valve of hydrazine powered engines is described. The poppet valve uses a pneumatic spring which holds the poppet valve against the piston while the valve is opened and closed. To accomplish this, a poppet valve is slidably mounted in a 'pneumatic spring' chamber which reaches a pressure approaching the gas supply pressure and, during the opening of the valve, the 'spring' chamber retains enough pressure to hold the poppet valve onto the piston. In addition, the bottom of the poppet valve can have a suction cup type configuration to hold the poppet valve on the piston on the down stroke. NASA

N78-11400# Texas A&M Univ., College Station. Dept. of Mathematics.
THE SLIDING OF A RIGID INDENTOR OVER A POWER LAW VISCOELASTIC HALFSPACE Interim Report
J. R. Walton, A. Nachman, and R. A. Schapery 1977 57 p refs
(Grant AF-AFOSR-3290-77)
(AD-A043232; AFOSR-77-0995TR) Avail: NTIS HC A04/MF A01 CSCL 20/11

Closed form solutions are obtained for the problem of a rigid asperity sliding with Coulomb friction over a power law viscoelastic halfspace. The dual integral equations relating the unknown normal traction under the contact interval (also unknown) to the unknown normal displacement outside the contact interval are solved by first reducing the system to a generalized Abel integral equation and then appealing to the theory of Riemann-Hilbert boundary value problems. The physical quantities of interest (eg. the coefficient of sliding friction) are determined for the three canonical indentors: a parabolic punch, a wedge punch and a flat punch. It is observed that for certain power law materials, singularities in the normal traction field occur even for the smooth parabolic indentor. Author (GRA)

N78-11401# Computer Code Consultants, Solana Beach, Calif.
THREE DIMENSIONAL COMPUTATIONS. VOLUME 1: THE 30 DEG OBLIQUE IMPACT Final Report, Apr. 1977
W. Johnson and V. Kucher Jul. 1977 78 p refs
(Contract DAAD05-76-C-0755; DA Proj. 1W1-61102-A-33H)
(AD-A043295; BRL-CR-344) Avail: NTIS HC A05/MF A01 CSCL 19/4

Numerical computations were made in 1975 of four oblique impact problems: 30 deg, 45 deg, 60 deg, and 77.5. A graphical

display of the results of the 30 deg impact of a copper jet on a steel target are presented. Author (GRA)

N78-11402# Ballistic Research Labs., Aberdeen Proving Ground, Md.
TEMPERATURE MEASUREMENT OF RESIDUAL PENETRATION FRAGMENTS
W. G. VonHolle, G. Melani, J. Waddell, and R. Frey Jul. 1977 35 p refs
(AD-A043294; BRL-MR-2770) Avail: NTIS HC A03/MF A01 CSCL 19/4

The temperature of residual fragments from the low velocity penetration of 1.27 steel spheres into various targets has been measured by 2-band infrared radiometry. The residual velocities of the fragements were also measured. The temperatures correlate well with the predictions of a simple model based on the conversion of mechanical energy to heat. The residual velocities correlate with theoretical and previous empirical data.
Author (GRA)

N78-11403# North Carolina Univ., Charlotte. Dept. of Mathematics.
SHOCK AND WEAR MODELS AND THE RELATED REPLACEMENT POLICIES Final Report
M. Abdel-Hameed 1977 12 p refs
(Grant AF-AFOSR-2999-76)
(AD-A043674; AFOSR-TR-77-0941) Avail: NTIS HC A02/MF A01 CSCL 05/1

During this period the principal investigator was partially supported and performed research in the areas of shock models and wear processes, maintenance and replacement policies for devices subject to shocks or wear, and positive dependent of life distributions. The research activities resulted in six publications with the following titles: 'Optimal Replacement Policies for Devices Subject to a Gamma Wear Process,' 'Optimality of the One Step Look-Ahead Stopping Times,' 'When to Stop a War,' 'Positive Dependence of the Bivariate and Trivariate, Absolute Normal, t, Chi-Square, and F Distributions,' 'Discrete Version of Dynkin's Identity,' and 'Optimal Replacement of Damaged Devices.' GRA

N78-11404# Sandia Labs., Albuquerque, N. Mex.
FILAMENT-REINFORCED CYLINDRICAL PRESSURE VESSELS: ANALYSIS AND NUMERICAL EVALUATION
M. Moss Mar. 1977 19 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0403) Avail: NTIS HC A02/MF A01

The response to internal pressure of a cylindrical vessel consisting of a metal liner reinforced with a circumferentially wound filament-epoxy composite has been analyzed. Expressions for pressures required to produce the onset of yielding and complete yielding in the liner, failure of the composite, and efficiencies are derived for all combinations of three liner materials (HP-9-4-20 steel, 6061-T6 Al, and Ti-6Al-4V), and three composites (Kevlar 49-epoxy, Thornel 400-epoxy, and Thornel 75-epoxy). Failure pressures are highest for the Kevlar 49-reinforced vessels. At lower failure pressures, 6061-T6 Al/Kevlar 49-epoxy vessels are most efficient as measured by the product of failure pressure and interior volume divided by vessel mass. ERA

N78-11405# Chrysler Corp., Detroit, Mich.
BASELINE GAS TURBINE DEVELOPMENT PROGRAM Quarterly Progress Report
F. W. Schmidt and C. E. Wagner 31 Oct. 1976 112 p
(Contract EY-76-C-02-2749)
(COO-2749-16; QPR-16) Avail: NTIS HC A06/MF A01

A program is reported which demonstrates an experimental ungraded gas turbine powered automobile that meets the 1978 Federal Emissions Standards, has significantly improved fuel economy, and is competitive in performance, reliability, and potential manufacturing cost with the conventional piston engine powered, compact-size American automobile. Principal effort was in the area of diagnostic testing and corrective development. Three upgraded engines were assembled and two were run in the test cell. Special diagnostic instrumentation was installed on engine number three to evaluate the compressor, turbine, and hot engine leakage. Engine airflow, starting characteristics, oil flow/heat rejection/blowby, emissions, leakage, and component performance tests were conducted. ERA

N78-11406# National Swedish Road and Traffic Research Inst., Linkoeping.
THE EFFECT OF DAY-TIME VEHICLE LIGHTING ON ROAD ACCIDENTS IN FINLAND [EFFEKT PAA TRAFIKOLYCKOR AV REKOMMENDERAD OCH PAAKALLAD ANVAENDNING AV VARSELLJUS I FINLAND]
Kjell Andersson, Goeran Nilsson, and Markku Salusjaervi (Statens Tek. Forskningscentral, Esbo, Finland) 1976 100 p In SWEDISH; ENGLISH summary
(VTI-102) Avail: NTIS HC A05/MF A01

Investigations were based on Finnish statistics on accidents occurring on the national road network and reported to the police. The relevance of these statistics to road safety precautions stems from the fact that various measures have been taken to increase the use of vehicle running lights in Finland outside urban areas during the winter period and that these measures have resulted in a very high frequency of use. The conclusion is that, although an analysis of this type is hampered by the presence of other precautions and by variations in external conditions, the results obtained strongly indicate that the use of running lights greatly reduces accidents. Author (ESA)

N78-11407# European Space Research and Technology Center, Noordwijk (Netherlands). Materials Section
THE MANUAL SOLDERING OF HIGH-RELIABILITY ELECTRICAL CONNECTIONS
Paris ESRO 1 Sep. 1973 62 p
(ESRO-PSS-14/QRM-08P-Issue-1) Avail: NTIS HC A04/MF A01

The rigorous standards set by this specification ensure the high reliability of hand soldered electrical connections intended to withstand normal terrestrial conditions and the vibration, G-loads and environment imposed by space flights. The proper tools, correct materials, design and workmanship are covered. The finished joints are given a final 100 percent visual inspection. Acceptance and rejection criteria are stated and some photographs are included to differentiate between proper and improper work. ESA

N78-11408# Bristol Univ. (England). Dept. of Mechanical Engineering.
AN INVESTIGATION INTO THE PERFORMANCE OF A VORTEX PUMP B.S. Thesis
J. R. Perkins Jun. 1977 51 p refs
(BU-77/B.9) Avail: NTIS HC A04/MF A01

A feasibility study was undertaken to investigate the performance of a vortex pump, to replace an ejector in a heat pump cycle. Theoretical predictions were made as to the overall pressure drops within such a pump and compared to results obtained by using an experimental pump. The pump produced a maximum suction pressure of 50 cm Hg and a maximum entrained flow of 0.006 cubic meters/second with a primary driving flow of 0.011 cubic meters/second, which is a considerably poorer performance than an ejector operating under similar conditions. Author (ESA)

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N78-11409# Claremont Mens Coll., Calif. Inst. of Decision Science.
[PROBABILISTIC AND STATISTICAL PROPERTIES FOR MIXED EXPONENTIAL DISTRIBUTION] Final Report
Janet Myhre Aug. 1977 114 p refs
(Contract N00014-76-C-0695)
(AD-A043857) Avail: NTIS HC A06/MF A01 CSCL 14/4

The following topics are discussed: (1) determining confidence bounds for highly reliable coherent systems based on a paucity of component failures; (2) problems of estimation for a decreasing

failure rate distribution applied to reliability comparison of parameter estimation for the Pareto distribution; (3) HP-97 programs for the computation of maximum likelihood estimates for the parameters of the mixed exponential distribution; (4) reliability tutorial and approximate confidence bounds for reliability; and (5) mixed exponential distribution. GRA

N78-11410# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
FAILURE RATES
Paris ESA Dec. 1976 53 p
(ESA-Spec-QRA-14-Issue-4) Avail: NTIS HC A04/MF A01

The failure rates of electrical parts, electromechanical parts, and some mechanical parts, are provided to be used for the purposes of reliability prediction and associated activities on ESA programs. In addition to failure rates, supporting data are given on the relative percentages of occurrence of part failure modes, environmental factors and quality factors, and the relationship between failure rates and electrical and theoretical stresses. ESA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N78-11411 Illinois Inst. of Tech., Chicago.
FINITE ELEMENT ANALYSIS OF NONLINEAR ELASTO-PLASTIC-SLACK CABLE NETWORKS Ph.D. Thesis
David Chia-Chiun Ma 1976 82 p
Avail: Univ. Microfilms Order No. 77-13751

A numerical procedure for determining the dynamic response of a cable system having both nonlinear geometry and material effects was developed. Individual cable elements in the cable network are assumed either slack, elastic, or plastic within mathematical analogue depending on the time-history of load and system response. In the slack case the element deforms isometrically and does not contribute to the stiffness of assemblage, but does effect the inertia and load terms. In the plastic case, the element contributes to the stiffness, inertia, and load terms but in a different fashion than when elastic. The solution method was verified by comparison with existing solutions for several examples. A three dimensional problem with cable or rigid elements subjected to constant load or periodic load was used to study plasticity and cable slackening effects.
Dissert. Abstr.

N78-11412 Massachusetts Univ., Amherst.
RESPONSE OF PARTIALLY FILLED LIQUID-STORAGE CIRCULAR CYLINDRICAL TANK WITH OR WITHOUT AN INTERIOR CYLINDRICAL BAFFLE UNDER SEISMIC ACTIONS USING FINITE ELEMENT TECHNIQUE Ph.D. Thesis
Samia Hafiz Shaaban 1977 237 p
Avail: Univ. Microfilms Order No. 77-15121

The structure under consideration is an elastic cylindrical liquid storage tank attached to a rigid base slab. The tank is either empty or filled to an arbitrary depth with an inviscid, incompressible liquid. A finite element analysis is presented for both tank and liquid, to investigate the free vibration of the coupled system permitting determination of natural frequencies and associated mode shapes. Sanders shell theory is employed to express the strain-displacements relationship in the derivation of the shell finite element. The response of the tank to artificial earthquake excitation is also determined. Similar investigations are performed with the addition of an elastic cylindrical perforated baffle to control the system natural frequencies. Dissert. Abstr.

N78-11413 Illinois Univ., Chicago.
AN ASYMPTOTIC TREATMENT OF THE PROBLEM OF THE BUCKLED CYLINDRICAL SHELL UNDER AXIAL COMPRESSION Ph.D. Thesis
Ambar Nath Mukherjee 1977 88 p
Avail: Univ. Microfilms Order No. 77-15331

The asymptotic post-buckling behavior of the thin cylindrical shell under axial compression was studied. A moderately large deflection theory was considered such that the displacements are large in comparison with the shell thickness but still small in relation to the span for a sufficiently large number of wave numbers. A Pogorelov-type deflection pattern was assumed in considering developable surfaces separated by boundary layers. The solution of the equation of compatibility as well as the equation of equilibrium normal to the deflected shell surface is sought through a singular perturbation method. Because the straightforward perturbation solution is not uniformly valid throughout the field of interest, it was supplemented by the boundary layer approximation. Dissert. Abstr.

N78-11414 Illinois Inst. of Tech., Chicago.
A PROBABILISTIC ANALYSIS OF RIBBED PLATES Ph.D. Thesis
Ramsis Tewfik Sarofim 1976 123 p
Avail: Univ. Microfilms Order No. 77-13756

Formulas for random response of ribbed plates are presented in closed-form solutions that incorporate the effect of randomness of the load and design parameters. The solution is general with respect to the loading function and its random representation, and have certain advantages over the only alternative one by open-form solution. Linear statistical models are presented to determine the probabilistic characteristics of the structural response with respect to the statistical moments of the design parameters and loading functions. Models studied are: (1) non-composite flexural analysis, (2) composite membrane analysis, and (3) composite membrane flexural analysis. Illustrative examples are given for each case studied. Dissert. Abstr.

N78-11415 California Univ., Berkeley.
AXISYMMETRIC SOLUTIONS FOR JOINED DISSIMILAR ELASTIC SEMI-INFINITE CYLINDERS AND RELATED PROBLEMS Ph.D. Thesis
Vinod Kumar Agarwal 1976 82 p
Avail: Univ. Microfilms Order No. 77-15584

Transform methods are used to reduce problems to systems of singular integral equations. The kernels of the integral equations are found to contain Cauchy as well as generalized Cauchy-type singularities. The dominant part of the equations is separated and analyzed to determine the indexes of the singularities for various material parameter combinations. An approximate method is used to solve the system of singular integral equations numerically and various physical quantities of interest, such as normal and shear stresses at the interface, are obtained.
Dissert. Abstr.

N78-11416 Catholic Univ. of America, Washington, D. C.
VIBRATIONS OF PROLATE SPHEROIDAL SHELLS OF CONSTANT THICKNESS Ph.D. Thesis
Courtney Brice Burroughs 1977 35 p
Avail: Univ. Microfilms Order No. 77-17514

The general displacement-equilibrium equations, which include the effects of transverse shear and rotary inertia, were derived for a fluid-loaded prolate spheroidal shell of constant thickness subject to an harmonically time-varying, arbitrary spatially distributed force normal to the shell surface. The solution is formulated for axisymmetric motion of a shell that is immersed in an inviscid fluid of infinite extent. The approximate solutions for the two nontorsional displacements of the shell middle surface and the nontorsional rotation of the shell cross-section are obtained by using an extension of Galerkin's variational method. Numerical results are presented for the seven lowest axisymmetric natural frequencies of the shell in vacuo. Good agreement with other published results is obtained for the approximate natural frequencies of a thin prolate spheroidal shell and for the exact natural frequencies of a thick spherical shell. Additional results are presented for the natural frequencies of moderately thick shells as a function of shell eccentricity, mode number, and shell thickness. Dissert. Abstr.

N78-11417 California Univ., Berkeley.
THE MECHANICAL BEHAVIOR OF POROUS SOLIDS Ph.D. Thesis
John Henry Curran 1976 83 p
Avail: Univ. Microfilms Order No. 77-15647

The linear, elastic solution for a hollow sphere subject to homogeneous tractions on the outer boundary is obtained. Assuming that the matrix material is governed by the Drucker-Prager yield criterion, the elastic solution was used to derive an analytic expression for the onset of yield in the hollow sphere. The expression for the initial yield surface shows that the presence of a shear stress hastens the onset of yield in the sphere in comparison to a purely hydrostatic loading condition. This result agrees well with experimental data which shows that, for porous solids, permanent crush-up begins at a lower mean stress under a nonhydrostatic loading than when the applied loading is a uniform pressure. At this point, due to difficulty in obtaining an analytic solution, a numerical scheme (finite element method) was used to extend the analysis of the hollow sphere problem into the elasto-plastic range. The spherical model results clearly exhibit the experimental finding that the presence of a shear stress tends to enhance the volumetric compaction of porous solids in comparison to a purely hydrostatic loading condition.
Dissert. Abstr.

N78-11418 Utah Univ., Salt Lake City.
EVALUATION OF LAYERED MATERIAL PROPERTIES FROM MEASURED SURFACE DEFLECTIONS Ph.D. Thesis
Thomas Yih Hou 1977 155 p
Avail: Univ. Microfilms Order no. 77-17588

An important input in the analysis of layered systems, such as highway pavements, is the correct characterization of the constituent materials. A numerical solution is presented to the inverse problem of determining the in-situ-mechanical properties of a layered elastic system using measured surface deflections as input. Initial trial values of layer moduli and Poisson's ratios are used for the calculation of an initial estimated surface displacement field which is used in a least-squares curvefit of the field measured deflection basin. The minimization of the difference between the estimated and the measured displacements is implemented in a computer program developed for theoretical solution of an n-layered elastic system by means of successive approximations. Unique values of the elastic moduli are obtained.
Dissert. Abstr.

N78-11419 California Univ., Los Angeles.
A NEW APPROACH TO ELEASTIC-PLASTIC DYNAMIC ANALYSIS OF SIMPLY SUPPORTED BEAMS AND RECTANGULAR PLATES Ph.D. Thesis
Shih-Chang Liu 1977 45 p
Avail: Univ. Microfilms Order No. 77-16185

A numerical method for analyzing the elastic-plastic beams and rectangular plates subjected to dynamic loadings was developed. The analytical solutions of anelastic beam and anelastic plate subjected to a step concentrated load were used to generate the dynamic influence coefficients which were then used in step-by-step procedures to analyze the elastic-plastic beam and plate. This enables the elimination of numerical integration of the equations of motion with respects to time as well as the effort of solving a system of linear equations to satisfy the equilibrium at nodal points for the finite element method or at grid points for the finite difference method. Numerical results calculated for a simply supported beam subjected to a step lateral load agreed well with the results provided by previous work using the finite element or the finite difference techniques. The effective period and amplitude of vibration of the elastic-plastic beam and plate increase with the magnitude of the step lateral load.
Dissert. Abstr.

N78-11420*# Analytical Mechanics Associates, Inc., Jericho, N.Y.
COMPLEX EIGENVALUE EXTRACTION IN NASTRAN BY THE TRIDIAGONAL REDUCTION (FEER) METHOD
Malcolm Newman and Frederick I. Mann Sep. 1977 42 p refs
(Contract NAS1-14679)
(NASA-CR-145258; AMA-77-17) Avail: NTIS HC A03/MF A01 CSCL 20K

An extension of the Tridiagonal Reduction (FEER) method to complex eigenvalue analysis in NASTRAN is described. As in the case of real eigenvalue analysis, the eigensolutions closest to a selected point in the eigenspectrum are extracted from a reduced, symmetric, tridiagonal eigenmatrix whose order is much lower than that of the full size problem. The reduction process is effected automatically, and thus avoids the arbitrary lumping of masses and other physical quantities at selected grid points. The statement of the algebraic eigenvalue problem admits mass, damping and stiffness matrices which are unrestricted in character, i.e., they may be real, complex, symmetric or unsymmetric, singular or non-singular.
Author

N78-11421# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
EXACT EQUATIONS OF MOTION FOR A DEFORMABLE BODY Final Report
W. Jerkovsky 29 Mar. 1977 127 p refs
(Contract F04701-76-C-0077)
(AD-A042550; TR-0077(2901-03)-4; SAMSO-TR-77-133)
Avail: NTIS HC A07/MF A01 CSCL 20/11

The exact equations of motion for an arbitrary deformable body undergoing large deformation are presented in two forms. One of the forms is a momentum formulation and the other is a velocity formulation. Both forms of the equations of motion are derived by vectorial methods, but the resulting equations are shown to be the same as those obtained from a Hamiltonian or Lagrangian formulation. The generality of the final equations is due in part to modeling the deformable body as N particles and separating the degrees of freedom into 6 external or rigid body and into n is less than or equal to 3N - 6 internal or deformation degrees of freedom. The internal or deformation degrees of freedom are represented by n generalized coordinates. There is no assumption that these internal or deformation coordinates are small or that their time derivatives are small. The final equations of motion are indendent of the material properties of the body under consideration. In order to make specific use of these equations, specific constitutive equations must be postulated. The most typical constitutive equations used in the spacecraft dynamics literature are to consider the deformable body to consist of a collection of hinged rigid or linearly elastic sub-bodies; then the deformation within one of these sub-bodies is small, but the deformation between the sub-bodies may be arbitrarily large.
GRA

N78-11422# Princeton Univ., N. J. Dept. of Civil and Geological Engineering.
LINE CRACK SUBJECT TO SHEAR
A. Cemal Eringen Jul. 1977 35 p refs
(Contract N00014-76-C-0240)
(AD-A043455; Rept-77-SM-10; TR-46) Avail: NTIS HC A03/MF A01 CSCL 20/11

Flat plate models, Cracking Fracturing, Shear stresses, Elastic properties, Differential equations, Integral equations, Numerical analysis, Surface properties, Fracture Mechanics, Chemical bonds, Brittleness, Lines Geometry, Surface energy, Computations, Steel, Dislocations, Boundary value problems Field equations of nonlocal elasticity are solved to determine the state of stress in the neighborhood of a line crack in an elastic plate subject to a uniform shear at the surface of the crack tip. A fracture criterion based on the maximum shear stress gives the critical value of the applied shear for which the crack becomes unstable. Cohesive stress necessary to break the atomic bonds is calculated for brittle materials.
Author (GRA)

N78-11423# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
EVALUATION TESTS OF BEN-WELD NUMBER 11 REINFORCING STEEL Final Report, Jun. - Dec. 1972
James R. Hossley Sep. 1973 43 p refs
(AD-A043645; WES-MP-N-73-5) Avail: NTIS HC A03/MF A01 CSCL 11/6

The objective of this study was to determine the tensile properties at fast load rates of welded Ben-Weld No. 11 concrete reinforcing steel bars. Ben-Weld is a trade name of the U.S. Steel Corporation, Pittsburgh, Pennsylvania. Nineteen tension tests were conducted. Twelve samples were spliced using three different welding methods; i.e., direct single-vee groove weld, direct double-vee groove weld, and indirect angle splice. Four of the sample bars were passed through and welded to a 1/4-inch-thick steel plate to simulate the rebar penetrations of the electromagnetic pulse (EMP) shields used in the Perimeter Acquisition Radar Building (PARB) of the SAFEGUARD System. All samples were

tested at static and dynamic (intermediate) loading rates. The time to reach yield at the intermediate loading rate was approximately 0.10 second. Transient load and strain measurements were recorded during the tests. The results of these tests showed that a welded Ben-Weld bar will exceed the minimum requirements for tensile and yield strengths for Grade 60 bars as stipulated by the American Society for Testing and Materials. The test results also indicated that welding does not seriously affect the ductility of the material and that final elongations of approximately 20 percent can be expected from welded rebars. Author (GRA)

N78-11424# Naval Intelligence Support Center, Washington, D. C. Translation Div.

A STUDY OF THE EFFECT OF WELDING STRESSES ON THE SUPPORTING POWER OF TITANIUM ALLOY WELDED MEMBERS UNDER STATIC AND CYCLIC LOADING

A. N. Serenko and S. Kh. Ramazanov 19 May 1977 17 p refs Transl. into ENGLISH of Tr. Leningr. Politekhn. Inst. (USSR), no. 262, 1966 p 26-34

(AD-A043712; NISC-Trans-3931) Avail: NTIS HC A02/MF A01 CSCL 11/6

Determining the degree to which welding stresses affect the performance of welded members and structures under various types of operational loads is of important practical significance. Scientific studies in the field of welding, therefore, have long focused on resolving questions connected with this problem. As a result of the ever-increasing demands on the supporting power of welded structures and the growing complexity of the conditions under which they operate, as well as the increasingly wide-spread use of new structural metals and alloys in industry, the problem of the effect of welding stresses on the strength of welded structures remains current at the present time. Author (GRA)

N78-11425# California Univ., Berkeley. Earthquake Engineering Research Center.

SUBWALL: A SPECIAL PURPOSE FINITE ELEMENT COMPUTER PROGRAM FOR PRACTICAL ELASTIC ANALYSIS AND DESIGN OF STRUCTURAL WALLS WITH SUBSTRUCTURE OPTION

Dao Quang Le, Petersson Hans, and Egor P. Popov Mar. 1977 98 p refs

(Grant NSF AEN-76-04263)

(PB-270567/1; UCB/EERC-77/09) Avail: NTIS HC A05/MF A01 CSCL 13M

A computer program is developed for the linear structural analysis and design of complex reinforced concrete walls subjected to arbitrary in-plane static loadings. Openings and offsets in structural walls are represented by special hole elements with no structural stiffness. Few cards are necessary for a relatively large size structure. Joint coordinates, element connectivities, and boundary conditions are automatically generated. GRA

N78-11426# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

REVIEW OF INVESTIGATIONS ON AERONAUTICAL FATIGUE IN THE FEDERAL REPUBLIC OF GERMANY, MAY 1975 - APRIL 1977

O. Buxbaum and D. Schuetz 1977 149 p refs Presented at the 15th Conf. of the Intern. Comm. on Aeron. Fatigue, Darmstadt, West Ger., 1977

(LBF-S-133) Avail: NTIS HC A07/MF A01

Research carried out in the field of fatigue of aircraft structures is reviewed. Topics covered include measurement and analysis of operational loads; fatigue behavior of notched specimens and joints; fatigue life prediction cyclic stress-strain behavior, and low cycle fatigue; crack propagation, fracture mechanics, and residual static strength; fatigue of fiber reinforced plastics; and full-scale tests, tests with large components, and service failures. ESA

N78-11427# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.

MANUFACTURE OF A STIFFENED CFRP PANEL AND AN EXPERIMENTAL EVALUATION OF ITS BUCKLING CHARACTERISTICS

Lennart Knutsson 1977 31 p refs

(FFA-HE-1971) Avail: NTIS HC A03/MF A01

An integrally stiffened shell panel was manufactured from carbon fiber epoxi prepreg. Stiffeners and plate were made separately using autoclave curing, and were bonded together. The panel was tested in a compression load machine, with the ends clamped and the sides simply supported. The buckling deformation was obtained by the shadow Moire method. The experimentally found value of the buckling load of the panel was compared with a theoretically calculated buckling load. Good correlation was found between the theoretical and the experimental buckling load. Author (ESA)

N78-11428# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

THE APPLICATION OF FRACTURE MECHANICS TO CREEP CRACK GROWTH

H. P. vanLeeuwen 13 Oct. 1976 52 p refs

(NLR-MP-76025-U) Avail: NTIS HC A04/MF A01

Creep cracking test results, analyzed using various parameters such as the stress intensity factor, net section stress, crack opening displacement, and deformation energy rate, are reviewed. Theoretical predictions of creep crack growth rate on the basis of creep laws are discussed. Creep crack growth due to vacancy diffusion and condensation is considered. Analytical treatments are reviewed. A new solution is presented. Author (ESA)

N78-11429# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Manufacturing Research and Product Development Dept.

INVESTIGATION INTO ALUMINIUM WINDOW PANE MASKING MATERIALS WITH RESPECT TO CRAZING

W. Nieland 6 Jan. 1977 4 p

(FOK-R-2093) Avail: NTIS HC A02/MF A01

The results of tests on adhesive coated aluminum used to protect aircraft window panes are given. Flexion tests showed no surface cracks generated by application of the tape on the pane. ESA

N78-11430# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

XB EXPERIMENTAL BUS SYSTEM. DEVELOPMENT OF A UNIVERSAL COMPUTER SUPPORTED MULTIPLE USER TEST CONTROL SYSTEM [XB EXPERIMENTAL BUS SYSTEM. ENTWICKLUNG EINER UNIVERSELLEN RECHNERGESTUETZTEN EUERUNG]

John H. Argyris, W. Aicher, and M. Mueller 1977 193 p refs In GERMAN

(ISD-200) Avail: NTIS HC A09/MF A01

A new test control system for structural analysis, including the latest hardware and software developments, is described. The system supports multiple use and is based on the finite element method. The software was developed for the PDP 11-50 computer and operating system RSX-11 D. For test control and measured data collection FORTRAN subroutines are available. The X-bus is an 80 channel cable with address and data lines for the digital information transfer. The X-bus is connected via the X-bus controller to the central processing unit. Up to 8 measuring terminals can be connected to the XB-controller. ESA

N78-11431# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

LINEAR SYSTEMS WITH A LARGE NUMBER OF SPARSE CONSTRAINTS WITH APPLICATIONS TO INCOMPRESSIBLE MATERIALS

John H. Argyris, P. C. Dunne, T. L. Johnsen, and M. Mueller Oct. 1976 40 p refs

(ISD-206) Avail: NTIS HC A03/MF A01

A finite element model for treating completely incompressible elastic continua in the small strain domain was examined in detail from computational aspects as applied to static and dynamic structural problems. Examples are given. ESA

N78-11432# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

FINITE ELEMENT MODELLING OF INELASTIC BEHAVIOR

John H. Argyris and K. J. William Nov. 1976 42 p refs Presented at the ASCE-EMD Spec. Conf. of Eng. Mech., Waterloo,

Ontario, 26-28 May 1976
(Grant BMFT-RK-21/SBB4)
(ISD-209) Avail: NTIS HC A03/MF A01

The interaction of finite element formulation, constitutive modelling, and numerical solutions is considered in the case of inelastic behavior of structural members. The mathematical idealization of the underlying rate process admitting aging, rate, and history dependence of deformations is dealt with on a phenomenological basis. ESA

N78-11433# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

INCREMENTAL FORMULATION IN NONLINEAR MECHANICS AND LARGE STRAIN ELASTO-PLASTICITY NATURAL APPROACH

John H. Argyris and M. Kleiber (Polish Acad. of Sci., Warsaw) 1976 54 p refs
(ISD-211) Avail: NTIS HC A04/MF A01

Numerical solution techniques of problems in continuum mechanics in the presence of finite elastic and plastic strain components are discussed. The techniques are based on the natural finite element formulation of large deformations. The proposed model requires the determination of an intermediate (stress-free) configuration at each step of the loading process. Certain approximations are adopted and comparisons are made to assess the difference between the natural approach with an intermediate reference configuration and conventional models for large displacements and small strains. Some numerical illustrations are given. Author (ESA)

N78-11434# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

CALCULATION OF TEMPERATURE AND HUMIDITY FIELDS IN MASSIVE CONSTRUCTIONS USING THE FINITE ELEMENT METHOD [BERECHNUNG VON TEMPERATUR- UND FEUCHTEFELDERN IN MASSIVBAUTEN NACH DER METHODE DER FINITEN ELEMENTE]

John H. Argyris, E. P. Warnke, and K. J. Willam 1977 108 p refs In GERMAN; ENGLISH summary
(Grant BMFT-RK-21-I/SBB4)
(ISD-213) Avail: NTIS HC A06/MF A01

The theoretical fundamentals of SMART 2 for the analysis of stationary and transient hygrothermal problems in heterogeneous continuums are described. The SMART (Structure Mechanical Analysis in Reactor Technology) consisting of SMART 1 for statistical calculations and SMART 2 for diffusion calculations, was developed on the basis of ASKA for the calculation of prestressed concrete reactor pressure vessels using the finite element method. One of the fields of applications is the heating or drying of thick walled prestressed concrete pressure vessels under special reactor conditions. The software package can also be used for the calculation of transport phenomena provided the diffusion law is valid. ESA

N78-11435# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

FROM PROGRAM SYSTEMS TO PROGRAMMING SYSTEMS FOR FINITE ELEMENT ANALYSIS

E. Schrem 1977 23 p refs Presented at the Symp. on Formulations and Computational Meth. in Dinite Element Anal., Boston, 8-13 Aug. 1976 and the ICASE Sem. at NASA Langley Res. Center, Hampton, Va., 13 Aug. 1976
(ISD-214) Avail: NTIS HC A02/MF A01

A virtual finite element machine is proposed as a tool to surpass the present day finite element method programs such as NASTRAN or ASKA. The command language, interpreter modules, control program data flow plan, activation graph, data management system, methods for partitioning of the degrees of freedom substructure analysis, and procedure definitions for assembling stiffness matrices are described. Results of a prototype are indicated. ESA

N78-11436# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

A RECTANGULAR LAMINATED ANISOTROPIC SHALLOW THIN SHELL FINITE ELEMENT

K. P. Rao 1977 40 p refs Sponsored by Alexander von Humboldt Stiftung
(ISD-217) Avail: NTIS HC A03/MF A01

Details of the development of the stiffness matrix for a rectangular laminated anisotropic shallow thin shell finite element are presented. The derivation was done under linear thin shell assumptions. Expressing the assumed displacement state over the middle surface of the shell as products of one-dimensional first-order Hermite interpolation polynomials, it is possible to insure that the displacement state for the assembled set of such elements is geometrically admissible. Monotonic convergence of the total potential energy is therefore possible as the modelling is successively refined. The element is systematically evaluated for its performance, taking into consideration various examples for which analytical or other solutions are available.
Author (ESA)

N78-11437# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

FINITE ELEMENT CALCULATION OF PRESTRESSED CONCRETE REACTOR PRESSURE VESSELS [FINITE ELEMENT-BERECHNUNG VON SPANNBETON-REAKTORDRUCKBEHAELTERN]

John H. Argyris, G. Faust, J. Szimmat, E. P. Warnke, and K. J. Willam Mar. 1977 73 p refs In GERMAN; ENGLISH summary
(Grant BMFT-RK-21-I/SBB4)
(ISD-219) Avail: NTIS HC A04/MF A01

Research and development on prestressed concrete reactor vessel (PCRV) analysis is summarized. Discretization problems were investigated for the finite element idealization of PCRV in addition to questions with regard to long term creep and concrete failure in the ultimate load regime. Special attention was given to the triaxial load conditions in massive structures and the specific concrete properties under hygrothermal environments. The finite element system SMART was programmed for the analysis of prestressed concrete reactor vessels. It consists of two parts: SMART I - Statics; SMART II - Diffusion. SMART serves both to static analysis of stresses and deformations and the computation of hygrothermal boundary conditions in massive structures within a compatible software package.
Author (ESA)

N78-11438# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

FINITE ELEMENT METHOD FOR RANDOM RESPONSE OF STRUCTURES DUE TO STOCHASTIC EXCITATION

S. S. Dey 1976 97 p refs
(ISD-221) Avail: NTIS HC A05/MF A01

Application of the finite element method to analyze the response of multi-degree linear elastic structures subjected to stationary random stochastic loading is described. Two methods, the complex matrix inversion method and the normal mode method, were used to compute the responses. The basic theory for these two approaches and relevant statistics are presented in detail. In the first approach, the global stiffness and mass matrices are used as input data; in the second approach, the eigenvalues and eigenvectors are used as input for random response calculations. As regards application to test problems, these can be classified broadly into two categories. In the first set of problems, the conventional finite element method was applied, utilizing ASKA 1 and ASKA 2 packages with their standard elements to form the global stiffness and mass matrices; subsequently, the eigenvalues and eigenvectors were computed. In the next set of problems, a combined finite element and harmonic function was used for two-dimensional structures. This procedure gives a very economical solution to a limited but important range of problems. To validate the numerical procedures, further verification was obtained for various problems by comparison with the analytic solution. Author (ESA)

N78-11439# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

STRUCTURAL ASPECTS OF SOFTWARE SYSTEMS FOR NONLINEAR FINITE ELEMENT ANALYSIS

E. Schrem 1977 25 p refs Presented at the Conf. on Finite Elements in Nonlinear Solid and Struct. Mech., Geilo, Norway, 29 Aug. - 1 Sep. 1977
(ISD-223) Avail: NTIS HC A02/MF A01

The basic contrasting properties of production software for

linear and nonlinear analysis are compared in terms of user-system interface, typical program size, problem solving capacity, and computer utilization. Necessity and feasibility of cleaner functional decomposition and simple data organization is discussed. The concept of a functional unit is introduced and two design alternatives for decomposing functions and data are presented in some detail. In the first alternative, called FDD design, functions and data are decomposed to the largest possible extent, yielding biunique correspondences between the objects of the theory and the objects of the software system. In the second alternative, called FDI design, functions and data are integrated in comprehensive functional units. The respective merits and demerits of the design concepts are compared. Author (ESA)

N78-11440# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

POST-BUCKLING FINITE ELEMENT ANALYSIS OF CIRCULAR CYLINDERS UNDER END LOAD

John H. Argyris and P. C. Dunne 1977 16 p refs
(ISD-224) Avail: NTIS HC A02/MF A01

Results of some initial and postbuckling finite element calculations for a cylindrical panel are given. Calculations of the initial buckling in the symmetrical mode for a complete cylinder using the Rayleigh-Ritz method are also given. For the initial buckling of a cylindrical panel TRUMP and SHEBA idealizations were used. Results confirm that the facet idealization produces adequate engineering accuracy when properly applied. ESA

N78-11441# Institut fuer Festkoerpermechanik, Freiburg (West Germany).

[ACTIVITIES OF THE INSTITUTE OF SOLID STATE TECHNOLOGY] Annual Report, 1976 [TAETIGKEITSBERICHT 1976]

1977 50 p refs In GERMAN
Avail: NTIS HC A03/MF A01

Activities reported include stress analysis and fracture mechanics under static loads; structural behavior of metallic material; structural behavior of nonmetallic material; and stress analysis and fracture mechanics under dynamic loads. ESA

N78-11442# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Abt. Thermoelastik.

EXPERIMENTAL DETERMINATION OF THE TEMPERATURE FIELD AND THE THERMAL STRESSES ON THERMALLY LOADED THICK-WALLED STRUCTURES, PART 2 [EXPERIMENTELLE ERMITTLUNG DES TEMPERATURFELDES UND DER WAERMESPANNUNGEN AN THERMISCH BEANSPRUCHTEN DICKWANDIGEN BAUTEILEN, TEIL 2]

G. Vollhardt (Tech. Hochschule Darmstadt, West Ger.) 1976 29 p refs In GERMAN; ENGLISH summary Presented at the 4th DGLR Colloq. 'Thermaltechnol.', Cologne, 23 Oct. 1975
(DLR-IB-152-76/08a) Avail: NTIS HC A03/MF A01

The determination of steady temperature - and stress fields in thermally loaded thick-walled structures, such as thick circular plates, typically used by apparatus and reactor industry are discussed. The experimental technique to determine temperature and thermal stress distributions is described; boundary conditions such as the influence of direct radiation on strain gages and support conditions are investiagted. The results on thick circular plates were compared with those obtained with the finite element method. By considering the unavoidable imperfections in experiments (e.g., construction and application of thermocouples and strain gages), the results of the temperature distribution and the stresses agree very well. The difficulties (e.g., the problem of describing the real support conditions of a plate in the experiment) become apparent. Author (ESA)

N78-11443# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strukturmechanik.

COMMENTS ON THE PAPER 'SOME COMPLEMENTS TO THE ECCS DESIGN CODE CONCERNING ISOTROPIC CYLINDERS'

M. Esslinger, B. Geier, and U. Heidemann 1 Apr. 1977 61 p refs Preliminary Report presented at the Liege Colloq., 13-15 Apr. 1977
(DLR-IB-152-77/06) Avail: NTIS HC A04/MF A01

The information contained in the preliminary report is supplemented. Only the numerical values of admissible geometric initial imperfections are modified. The imperfection factors are defined based on an evaluation of high-speed motion pictures, nonlinear shell computations, practical experience on the site, and American and British design specifications. ESA

N78-11444# Bristol Univ. (England). Dept. of Mechanical Engineering.

THE STRENGTH OF ECCENTRICALLY BORED TUBES B.S. Thesis

T. Pearce and J. Cape Jun. 1977 52 p refs
(BU-77/A.2) Avail: NTIS HC A04/MF A01

Much work was done, both experimentally and theoretically, on the strength of concentrically bored, thick walled, steel tubes subjected to internal pressure, but very little was done on eccentrically bored tubes. An experimental and two theoretical approaches to the latter problem are given. Five tubes of varying eccentricities and constant diameter ratio, and one concentric tube were pressure tested for failure. The material used was a low alloy steel. The results were compared with those predicted from an analytical theory developed by Jeffrey but never experimentally verified, and those obtained from a computed finite element solution. Agreement between theory and experiment was good and tentative explanations of the mechanism of deformation and failure are given. Author (ESA)

N78-11445# Bristol Univ. (England). Dept. of Mechanical Engineering.

STEADY-STATE FREQUENCY RESPONSE FROM TRANSIENT DATA B.S. Thesis

W. J. Newell and I. S. Reid Jun. 1977 101 p refs
(BU-77/B.7) Avail: NTIS HC A06/MF A01

The advantages and limitations of obtaining a steady-state frequency response from transient data, via the Fourier transform, were investigated. This was done both by theoretical and experimental work. The experimental work made use of a recently purchased electronic signal-capture apparatus to obtain the transient information, which was processed using the university computing facilities to produce graphical results. Author (ESA)

N78-11976# European Space Agency, Paris (France).

INFLUENCE OF THE DIRECTION OF THE FIRST HALF-CYCLE IN LOW-CYCLE FATIGUE

Georges Vidal and Jean-Louis Bernard *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-4 (ESA-TT-396) Jul. 1977 p 141-149 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-4, Jul.-Aug. 1976 p 247-250 Original report in FRENCH previously announced as A77-11161 (For availability see N78-11970 02-88)
Avail: NTIS HC A08/MF A01

N78-11999# European Space Agency, Paris (France).

ISOPARAMETRIC FINITE ELEMENTS OF MULTILAYER SHELL FOR THE CALCULATION OF AEROSPACE STRUCTURES IN COMPOSITE MATERIALS

Raoul Girard *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-2 (ESA-TT-408) Sep. 1977 p 173-177 ref Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-2, Mar - Apr. 1977 p 131-132 Original report in FRENCH previously announced as A77-32950 (For availability see N78-11991 02-02)
Avail: NTIS HC A09/MF A01

42 GEOSCIENCES (GENERAL)

N78-11995# European Space Agency, Paris (France).

THE PSP RESIN, A NEW THERMOSETTING MATRIX FOR HEAT AND FIRE RESISTANT LAMINATES

Marcel Ropars and Bertrand Bloch *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1077-2 (ESA-TT-408) Sep. 1977 p 96-122 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-2, Mar. - Apr. 1977 p 103-112 Original report in FRENCH previously announced as A77-32946

(For availability see N78-11991 02-99)
Avail: NTIS HC A09/MF A01

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N78-11446 Drexel Univ., Philadelphia, Pa.
TECHNIQUES FOR OPENING REGIONAL RADIATION BUDGETS FROM SATELLITE RADIOMETER OBSERVATIONS Ph.D. Thesis
Jose Fermin Pina 1977 216 p
Avail: Univ. Microfilms Order No. 77-17221

Methods developed for obtaining regional radiation budgets from wide field of view satellite radiometer measurements were discussed. The instantaneous technique yields values of the radiant emittance (We) and the radiant reflectance (Wr) which regions have during the time interval of a single satellite pass. The number of observations matches the number of regions under study and a unique solution is obtained using matrix inversion. Another method, termed the best fit technique, yields time averages of We and Wr for large time intervals. The number of observations in this technique is much greater than the number of regions considered, and an approximate solution is obtained by the method of least squares. Dissert. Abstr.

N78-11447*# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
WATER UTILIZATION, EVAPOTRANSPIRATION AND SOIL MOISTURE MONITORING IN THE SOUTH EAST REGION OF SOUTH AUSTRALIA Final Report
K. R. McCloy, K. J. Shepherd, and G. F. McIntosh, Principal Investigators 10 Jan. 1977 7 p refs Sponsored by NASA ERTS
(E78-10001; NASA-CR-155205) Avail: NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results. It was established that reliable estimates of sand and coastal scrub areas can be determined from LANDSAT image classification by the Vec classifier more economically than by conventional means from a map of the coastal zone produced by photointerpretation using 1:10,000 aerial photography. Current LANDSAT imagery is also suitable for monitoring for large scale storm damage to the zone, but the normal change in sand areas extent due to man's activity or other reasons, is about 5 to 10 m per year, occasionally being as great as 30 m per year, so that it is considered that LANDSAT D will have the resolution necessary to monitor these changes but not current imagery.

N78-11448*# National Aeronautics and Space Administration, Washington, D. C.
INVESTIGATION OF NATURAL ENVIRONMENT BY SPACE MEANS. GEOBOTANY, GEOMORPHOLOGY, SOIL SCIENCES, AGRICULTURAL LANDS, LANDSCAPE STUDY
S. V. Zonn, ed., L. A. Vedeshin, ed., and L. A. Grinberg, ed. Sep. 1977 288 p Transl. into ENGLISH from "Issled. Prirodnoy sredy Kosmicheskimi, Sredstuvami. Geobotan., Geomorfol., Pochvoyedeniye, Selskokhozyayst-Vennyye Ugodya, Landshaftovedeniye", Moscow, Acad. of Soc. of USSR, 1976 p 1-223 Presented at Conf. of Socialist Country Specialists on Remote Sensing of the Earth with Aerospace Means, Moscow, 8-14 Oct. 1975 Translation was announced as N76-11511 Transl. by Sci. Transl. Serv. Santa Babara Calif.
(Contract NASw-2791)
(NASA-TM-75041) Avail: NTIS HC A13/MF A01 CSCL 08F

Reports given by Soviet specialists at a meeting of Socialist countries on remote sensing of the earth using aerospace methods are presented. Author

N78-11449*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
FAR-INFRARED PHOTOMETRY WITH AN 0.4-METER LIQUID HELIUM COOLED BALLOON-BORNE TELESCOPE Ph.D. Thesis
Michael Ray Jacobson Aug. 1977 282 p refs
(Grant NGR-33-010-172)
(NASA-CR-155234; CRSR-673) Avail: NTIS HC A13/MF A01 CSCL 14E

A 0.4-meter aperture, liquid helium cooled multichannel far-infrared balloon-borne telescope was constructed to survey the galactic plane. Nine new sources, above a 3-sigma confidence level of 1300 Jy, were identified. Although two-thirds of the scanned area was more than 10 degrees from the galactic plane, no sources were detected in that region; all nine fell within 10 degrees and eight of those within 4 degrees of the galactic equator. Correlations with visible, compact H lines associated with radio continuum and with sources displaying spectra steeply rising between 11 and 20 microns were noted, while stellar objects were not detected. Author

N78-11450# Committee on Science and Technology (U. S. House).
EARTH RESOURCES INFORMATION SYSTEMS
Washington GPO 1977 93 p refs Rept. for Subcomm. on Space Sci. and Applications of the Comm. on Sci and Technol., 95th Congr., 1st Sess., Nov. 1977
(GPO-95-881) Avail: Subcomm. on Space Sci. and Applications

A series of hearings were held on the definition and scope of an earth resources information system and on the institutional arrangements required to transform LANDSAT from an experimental to an operational system. Mr. Charles W. Mathews, formerly the NASA Associate Administrator for the Office of Applications, submitted two reports which were used by the Subcommittee as a point of departure during the hearings. The subcommittee obtained views from several Federal agencies and departments including the Office of Science and Technology Policy, the Department of Agriculture, the Department of Interior, the Army Corps of Engineers, and the National Aeronautics and Space Administration. Discussions were held with State agencies and organizations with experience using LANDSAT data and with representatives from Comsat, General Electric Co., Earth Satellite Corp., and the Geosat Committee. Author

N78-11451*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AIRCRAFT SENSOR ANALYSIS PACKAGE SYSTEM DESCRIPTION
M. L. Forman Sep. 1977 28 p refs Submitted for publication
(NASA-TM-78038; X-933-77-236) Avail: NTIS HC A03/MF A01 CSCL 14B

An overview of the capabilities of the Aircraft Sensor Analysis Package (ASAP) is presented. The approach is nontechnical, and several output products are illustrated. The major features of the system are described in more detail than is found in the User's Guide to a potential user, or to a user looking for a specific capability to be incorporated in another system. Author

N78-11452*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A METHOD OF INVERSION OF SATELLITE MAGNETIC ANOMALY DATA
M. A. Mayhew Oct. 1977 19 p refs Presented at IAGA Meeting, Seattle, Aug. 1976 Submitted for publication
(NASA-TM-78039; X-922-77-260) Avail: NTIS HC A02/MF A01 CSCL 05B

A method of finding a first approximation to a crustal magnetization distribution from inversion of satellite magnetic anomaly data is described. Magnetization is expressed as a Fourier Series in a segment of spherical shell. Input to this procedure is an equivalent source representation of the observed anomaly field. Instability of the inversion occurs when high frequency noise is present in the input data, or when the series is carried to an excessively high wave number. Preliminary results are given for the United States and adjacent areas. Author

N78-11453*# Honeywell Radiation Center, Lexington, Mass.
MULTILAYERED (Hg,Cd)Te INFRARED DETECTOR Final Technical Report

W. G. Rae 16 May 1977 63 p
(Contract NAS9-14180)
(NASA-CR-151548) Avail: NTIS HC A04/MF A01 CSCL 20F

Multilayered mercury-cadmium telluride photoconductive detectors were developed which are capable of providing individual coverage of three separate spectral wavelength bands without the use of beam splitters. The multilayered 'three-color' detector on a single dewar takes the place of three separate detector/filter/dewar units and enables simpler and more reliable mechanical and optical designs for multispectral scanners and radiometers. Wavelength channel design goals (in micrometers) were: 10.1 to 11.0, 11.0 to 12.0, and 13.0. Detectivity for all channels was 1 x 10 to the 10th power cm-Hz 1/2/Watt. A problem occurred in finding an epoxy layer which had good infrared transmission properties and which also was chemically and mechanically compatible with HgCdTe processing techniques. Data on 6 candidate bonding materials are surveyed and discussed. Author

N78-11454*# Mississippi State Univ., Mississippi State. Mechanical Engineering Dept.
NUCLEONIC COAL DETECTOR WITH INDEPENDENT, HYDROPNEUMATIC SUSPENSION Final Report
E. William Jones and Kim Handy 10 Jun. 1977 49 p refs
(Contract NAS8-32214)
(NASA-CR-150465) Avail: NTIS HC A03/MF A01 CSCL 08I

The design of a nucleonic, coal interface detector which measures the depth of coal on the roof and floor of a coal mine is presented. The nucleonic source and the nucleonic detector are on independent hydropneumatic suspensions to reduce the measurement errors due to air gap. Author

N78-11455# World Meteorological Organization, Geneva (Switzerland).
MODERN DEVELOPMENTS IN HYDROMETRY, VOLUME 2
Padua Intern. Centre of Hydrol. 1976 520 p refs Proc. of the WMO Intern. Seminar, Padua, 8-13 Sept. 1975; co-sponsored by Intern. Centre of Hydrol., UNESCO, and Intern. Assoc. of Hydrol. Sci.
(WMO-427; ISBN-92-63-10427-1) Avail: NTIS HC A22/MF A01; WMO, Geneva

Topics presented include instrumentation; methods and techniques of observation; measurements under difficult conditions; accuracy of hydrometric measurements; inter comparison of hydrometric instruments; and remote sensing and telemetering techniques. For individual titles, see N78-11456 through N78-11490.

N78-11456# Societa Italiana Apparecchi Precisione, Bologna (Italy).
TRANSDUCER FOR WATER LEVEL VARIATION RECORDING
G. Ricciarelli and Giorgio Rossi (Ente Nazl. per l'Energia Elettrica, Venice) *In* WMO Mod Develop. in Hydrometry, Vol. 2 1976 p 3-12 refs (For availability see N78-11455 02-43)
Copyright. Avail: NTIS HC A22/MF A01; WMO Geneva

The use of modern techniques for data elaboration and automatic management of installations suggested the study of a transducer which furnishes data directly in digital form. A particular type of transducer is described. Its characteristics and possibilities are specified and some facilities where it is operating are described. Author (ESA)

N78-11457# Geological Survey, Bay Saint Louis, Miss.
EFFECT OF WEIGHT ON THE CALIBRATION OF INCLINOMETER VELOCITY METERS
Verne R. Schneider (Gulf Coast Hydrosci. Center) *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 13-23 ref (For availability see N78-11455 02-43)
Copyright. Avail: NTIS HC A22/MF A01; WMO, Geneva

An inclinometer velocity and direction sensor is a buoyant cylinder with stabilizing vanes. It is tethered at one end and deflected by an amount proportional to the stream velocity. A force balance on the inclined meter in the steady-state position indicates that the amount of inclination is a function of the current velocity, buoyant force, distance from the tether point to the center of buoyancy, total weight of the meter, distance to the center of weight, total frontal area of the meter, distance to the center of the area, and fluid density. These variables can be grouped into a single dimensionless parameter. In order to test the validity of the parameter, tow tank tests of two inclinometers, one positively and one negatively buoyant, having fixed geometry were conducted. The total weight of each inclinometer was varied. Tests showed that the parameter describes the rating data when the meter weight is varied. These results indicate that the inclinometer velocity meter is a satisfactory measuring device for two-dimensional current magnitude and direction within deflection angles of 10 to 70 deg. The velocity range can be adjusted by varying the total mass of the meter. Since meter calibration depends on fluid density, the rating determined in a fresh-water tow tank must be adjusted for fluid density in order to use the meter in sea water. Author (ESA)

N78-11458# Geological Survey, Bay Saint Louis, Miss.
A WATER-STAGE MANOMETER WITH AUTOMATIC ORIFICE PURGE
H. O. Wires *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 24-33 (For availability see N78-11455 02-43)
Copyright. Avail: NTIS HC A22/MF A01; WMO, Geneva

An updated, motorized water-stage manometer with automatic orifice purge, developed by the U.S. Geological Survey for measurement of stages in reservoirs and streams is described. The advantages over the conventional stilling well and its associated intakes are: lower cost, less maintenance, greater mobility, and better accuracy. This new model, designated the USGS STACOM Manometer, uses the time-honored bubbler system of balancing water-head pressure against mercury-head pressure, using nitrogen gas as the coupling medium. The system has been refined to offer constant bubble rate, low gas consumption, longer sensing tubes, and an accuracy of plus or minus 0.0015 meter (0.005 foot). The problem of orifice obstruction in alluvial stream channels has been significantly alleviated by placing the orifice in a well screen and using the automatic orifice purge. These features, combined with long-term operation on 6-volt battery power, make remote unattended operation possible. Data may be recorded on an analog strip chart or as digital punched paper tape. Author (ESA)

N78-11459# Plessey Radar Ltd., Cowes (England). Environmental Systems Dept.
ELECTRO-MAGNETIC STREAM GAUGING IN THE U.K.
J. D. Newman *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 34-57 refs (For availability see N78-11455 02-43)
Copyright. Avail: NTIS HC A22/MF A01; WMO, Geneva

The electromagnetic method of flow measurement has been successfully applied to rivers in the U.K. The technique uses a coil laid under the river bed to produce a vertical magnetic field, and voltage probes in the banks to pick up an induced potential proportional to the mean velocity of the water across the section. A measurement of the cross section, combined with the average velocity gives an output of discharge. Evaluation of the method in an artificial channel and a natural river showed the technique to maintain accuracy under adverse conditions, including weed growth, bed silting, skew flow, and variable sensitivity, due, for example, to tidal back up. Fish showed no mutual effect and the channel is not constricted. The cross section can be rectangular or trapezoidal with wide depth variation. High sensitivity of new instrumentation permits the measurement of very small probe signals (microvolts) in the presence of up to 100 mV pk/pk noise. This feature is the key to economic success as it allows for a coil with reasonable cable cross section and power consumption. Author (ESA)

N78-11460# Federal Inst. of Hydrology, Koblenz (West Germany)
OBSERVATION AND MEASUREMENT OF BEDLOAD TRANSPORT BY MEANS OF AN UNDERWATER TELEVISION CAMERA
Helmut Hinrich *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 58-73 (For availability see N78-11455 02-43)
Copyright. Avail: NTIS HC A22/MF A01; WMO, Geneva

Following initial information on the significance of bedload measurement, an underwater television system used to observe river bottom and bedload transport is described. The system comprises, inter alia, a television camera and an underwater lamp which are mounted on a frame of 150 kg weight and

lowered to the river bottom from a ship. The pictures can be recorded on tape for subsequent playback on land at the same speed as the recording or at a slow motion retardation ratio of 1 : 50. In addition, a device is described which, in complementation of the underwater observation of bedload transport, measures the variations in flow velocity 15 cm above the river bottom over a range of, for example, from 75 to 150 cm/s, and registers them on a tape recorder. It is a current meter with built-in d.c. generator the voltage fluctuations of which indicate the variation in flow velocity. Author (ESA)

N78-11461# Geological Survey, Bay Saint Louis, Miss.
COMPUTING BACKWATER AND DISCHARGE AT WIDTH CONSTRICTIONS IN WIDE, HEAVILY-VEGETATED FLOOD PLAINS
Verne R. Schneider and L. A. Druffel *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 83-93 refs (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

Available methods of computing backwater and discharge at width constrictions in heavily-vegetated flood plains where valley width is 4 to 10 times the bridge opening width underestimate backwater and overestimate discharge. An investigation of the field data indicated the energy losses were underestimated in the approach and the flow expansion reaches of the constriction. The prediction of energy loss was improved by developing a more accurate method of estimating the average flow distance in the approach reach and a better approximation of the mean energy flope in the flow expansion reach of the constriction. Field data for 27 floods at 18 bridge sites were used to compare the proposed methods with available methods. The mean error in computing backwater was reduced from 50 % with the available methods to 4% with the proposed method. Similarly, the mean error in computing discharge was reduced from 20 to 6%. Author (ESA)

N78-11462# Geological Survey, Miami, Fla.
QUANTITY AND QUALITY OF URBAN STORM WATER IN SOUTHEAST FLORIDA
C. B. Sherwood and H. C. Mattraw *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 94-108 ref (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

Rainfall, runoff, and water quality were monitored in a residential area in southeast Florida starting in March 1974. Rainfall was measured at three points in the area and the resulting runoff was measured in a storm sewer. Water samples were automatically collected in the storm sewer at intervals of 133 sec throughout the period of runoff. The instrumentation used was that developed by the U.S. Geological Survey. By September 1974, 104 rainfalls were recorded, 19 of which produced runoff great enough to trigger the water-sampling mechanism. Preliminary analyses indicate that the chemical quality of the storm-sewer runoff is highly variable. Precise relations between loads, concentrations, and runoff have not yet been established. In general, however, the highest concentrations of chemical constituents were found in runoff that occurs after long dry periods, and lowest concentrations in runoff that occurs during a period of frequent rainfall. Peak concentrations for individual storms - in milligrams per liter ranged from 5.7 to 0.7 for nitrogen, 1.35 to 0.15 for phosphorus, and 290 to 15 for chemical oxygen demand. A 1.1-inch (28 mm) storm of 30 min duration on June 16 resulted in a peak flow of 19 cu ft/sec (0.5 cu m/sec) and loads of 1.4 lbs (0.6 kg) of nitrogen, 0.5 lbs (0.2 kg) of phosphorus, and 15 lbs (6.8 kg) of chemical oxygen demand. Total coliform bacteria counts in some storms were as high as 1.8 million colonies per 100 ml of water. Author (ESA)

N78-11463# Ministry of Public Works, Caracas (Venezuela).
GAGING TECHNIQUES IN LARGE RIVERS
Luis Remiro *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 109-116 (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

Gage techniques using heavy boats for flow measurement in large rivers are described. ESA

N78-11464# Ministry of Irrigation (Egypt). Hydrological Research Dept.
MECHNICAL ANALYSES OF LOW CONCENTRATION OF SUSPENDED MATERIAL IN RIVER FLOW
M. Salah E. Shalash *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 117-137 (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

Silt concentration of the suspended load in the Nile flow at Gaafra was tabulated from 1929 to 1955. Solid concentration (sand, silt, clay) in the Nile was analyzed for the years 1955 to 1963. Silt concentration of the suspended load in the Nile flow at Gaafra was tabulated for the period from 1968 to 1974.ESA

N78-11465# Research Inst. for Water Resources Development, (VITUKI), Budapest (Hungary).
POSSIBILITIES AND LIMITATIONS OF NUCLEAR SUSPENDED SEDIMENT GAUGING
Laszlo Rakoczi *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 138-150 refs (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

The nuclear suspended sediment gages featuring on-the-spot determination of sediment concentrations and continuous recording of their change in time show considerable development both in hydrodynamically sound design and in nuclear specifications. The presented construction makes possible sediment concentration measurements also in the vicinity of the streambed. The changeable radiation source-detector distance extends the range of application of the device. The relatively high lowest detectable concentration limits the application of the nuclear gaging to the higher sediment concentration ranges, i.e., mostly to floods. The measurement of rarely occurring high concentrations is, however, of such great importance that it can justify the use of nuclear gages even if it is not continuous during the year. Author (ESA)

N78-11466# Geological Survey, Reston, Va.
FIELD OPERATION OF AUTOMATIC WATER QUALITY MONITORS
G. F. Smoot and J. H. Ficken *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 151-159 (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

A brief history of the experience of the U.S. Geological Survey in automatic water quality monitoring is presented. Systems and equipment now in use throughout the U.S. are described and the evolution in the design of the latest equipment is discussed. Past experience in automatic water quality monitoring has shown the need for some standardization in the methods of calibration and in system performance so that data generated by the monitors will meet acceptable levels of accuracy. Recommended methods for the acquisition of data using automatic water quality monitors are presented. System performance requirements are outlined and system calibration procedures are covered for water temperature, specific conductance, dissolved oxygen, pH, chloride ion, and turbidity. Author (ESA)

N78-11467# Department of Environment, Hull (Quebec). Water Resources Branch.
APPLICATION OF ELECTRONIC DISTANCE MEASURING DEVICES TO MEASUREMENT OF DISCHARGE AND SEDIMENT DEPOSITION
Percy Ian Campbell *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 160-170 refs (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

How the Canadian Dept. of Environment has adapted Electronic Distance Measuring Devices (EDMD's) to the measurement of both discharge and sediment changes in Canadian rivers is described. The application of EDMD's was developed to reduce manpower requirements in the field, to permit automatic data handling, and to make possible measurement techniques not otherwise feasible. Author (ESA)

N78-11468# World Meteorological Organization, Geneva (Switzerland).
SOME SPECIFIC PROBLEMS IN THE OPERATION OF A GAUGING STATION
James C. Lambie *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 171-190 (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

The accuracy of the record of discharge from a gaging station is dependent on the accuracy of the record of stage and of the relation established between stage and discharge. Some of the problems which arise in the operation of such a station are described and it is suggested that the quality of the stage recording instruments installed at the station should be related to the sensitivity of the station control and therefore of the stage discharge relation. A method of defining sensitivity to enable a comparison of this quality to be made station to station is proposed. The results of tests on different types of water level recorders, both when new and after years of field use, are given. Details are given of velocity pulsation patterns detected on a number of rivers and the effect of these on average velocity.
Author (ESA)

N78-11469# Atomic Energy Research Establishment, Harwell (England).
ULTRASONIC RIVER GAUGING
Ronald W. Loosemore *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 190-208 refs (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

The principle of a non-obstructive method for determining the total volumetric flow-rate in rivers is outlined, combining an ultrasonic measurement of mean water velocity at one depth with the output of a resistance water level sensor. An instrument based on these principles is described which provides automatically a direct numerical display of net discharge and mean water depth together with outputs on punched tape. It will operate at a mean water velocity of less than 0.01 m/sec. Some details of its performance at three river sites in the U.K. are given. A second instrument is also described, incorporating up to 8 ultrasonic measuring paths, in which the multiplexing, control, and arithmetic functions are provided by a single-chip microprocessor and separate single-chip calculator. It is intended for use in rivers which exhibit a wide range of stage. Author (ESA)

N78-11470# Department of the Environmental Water Data Unit, Reading (England).
SITE CALIBRATION OF ELECTROMAGNETIC AND ULTRASONIC RIVER GAUGING STATIONS
Michael John Green and Reginald Walter Herschy *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 209-231 refs (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO Geneva

The output of the experimental electromagnetic river gaging system is compared to a Crump weir and it is shown that the rating equation may be expressed independent of the cross sectional area of the river. A self calibrating procedure is described for the ultrasonic method of river gaging and compared to current metering and dilution gaging. An accuracy of plus or minus 11 % was achieved for the standard error of estimate for the electromagnetic method. The ultrasonic and current metering compared to within 6% and the dilution gaging between 3 and 14%. Author (ESA)

N78-11471# Research Inst. for Water Resources Development, (VITUKI), Budapest (Hungary).
SIMPLIFIED METHOD FOR MEASURING AND COMPUTING OF DISCHARGES IN OPEN CHANNELS
Janos Szekeres *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 232-244 (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

A simplified measuring method is introduced which requires the fulfilment of the following prerequisites: measuring with current meter signalling at each revolution; using uniform point distribution in the measuring verticals; and, using uniform observation time in every measuring point. Once the above conditions are accomplished, the data processing work may be remarkably simplified, i.e., the discharge may be determined within about 20 min by manual calculation. The results of this computation agree with the results obtained in the traditional way for about -1%. To make the river flow measurement easier and more accurate, an electronic counter was developed which counts the revolutions during a preset time and the number of the measuring points in the verticals. Author (ESA)

N78-11472# State Hydrological Inst. (USSR).
MEASUREMENTS UNDER DIFFICULT CONDITIONS
Mstislav I. Rusinov *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 260-274B (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

Present day methods for determining hydrometric measurements under difficult conditions (in arctic and tropical climates, during winter period, in case of unstable channel, unsteady motion, etc.) are described. Author (ESA)

N78-11473# Geological Survey, Bay Saint Louis, Miss.
THE USE OF A STANDARD RATING FOR THE PRICE PYGMY CURRENT METER
Verne R. Schneider and G. F. Smoot *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 275-284 ref (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

Fifty new Price pygmy current meters and 59 old Price pygmy current meters with new standard rotors were rated individually in a towing tank. An average rating of V = 0.293 N + 0.012 m/sec was established for the group of new meters. Repeated rating of two meters showed that under the best rating condtion, the individual Price pygmy meter rating is repeatable within 1.3%. In addition, there is no essential difference in the group of new meters. Using the average rating for the group of old meters gave slightly higher standard errors than the individual ratings, however, for practical purposes, the differences are not significant. Continuation of the use of individual ratings of Price pygmy current meters is probaly unnecessary with the implementation of precise standards in their manufacturing, rating, and use. Field repair of these meters seems possible. Author (ESA)

N78-11474# Thames Water Authority, Reading (England).
STAGE-DISCHARGE RELATIONSHIPS FOR GROUNDWATER
Richard J. Mander *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 285-297 refs (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

Hydrometry is concerned equally with methods as with means of measurement. In open channel work the end product is a measurement of total discharge without recognition of the component discharges combining to provide that total. Where the total discharge contains a major groundwater component, measurement of the groundwater discharge can be as important as that of the total discharge. Such a measurement is made possible if a groundwater stage-discharge relationship can be derived for the specified point of measured total discharge.
Author (ESA)

N78-11475# Geological Survey, Anchorage, Alaska.
HYDROMETRY UNDER ARCTIC CONDITIONS
Joseph M. Childers and James P. Meckel *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 298-303 (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

Streamflow measurement in Arctic Alaska requires special techniques and equipment in addition to those used in temperate regions. Annual snowmelt contributes practically all runoff in most years in Arctic streams. Variable ice and snow conditions require continuous discharge measurement to define the snowmelt hydrograph. Winter flow from Sept. to May produces channel ice, which hides the flow. Much effort and specialized ice drilling or trenching are necessary to find and measure the flowing water, or to ascertain that no flow exists. Special current meters and suspensions were designed for use through narrow drill holes. Remote sites accessible only by specialized aircraft require highly developed boating techniques where no bridges or cableways exist. If a hydrometric field party is to measure not only streamflow discharge but also suspended sediment and other water-quality parameters on each trip, travel is very expensive. Also, this means that the hydrometrists must be versatile and trained in many skills. Author (ESA)

N78-11476# Institute of Hydrology, Wallingford (England).
TELEMETERING RIVER LEVEL FROM A LARGE, REMOTE, TROPICAL AREA

Ian Strangeways *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 304-310 refs (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

The problems of designing a radio telemetry system for river forecasting in a remote area of Brazil are discussed. The area concerned is of about 490,000 sq km, lacks more than rudimentary road or rail transport or a telephone network, and is virtually unpopulated and undeveloped. The sophisticated back-up required by complex instruments is in the distant modern cities on the coast. The equipment used, and the results achieved, are described. The importance of the part people play in instrument networks is discussed and a plea is made for instrument systems designed to fit the circumstances. Author (ESA)

N78-11477# Geological Survey, Reston, Va.
ACCURACY OF CHANNEL MEASUREMENTS AND THE IMPLICATIONS IN ESTIMATING STREAMFLOW CHARACTERISTICS
Kenneth L. Wahl *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 311-319 refs (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

Regional relations between flow characteristics and stream channel size offer a promising alternative to available methods of estimating flow characteristics for ungaged sites, particularly in semiarid regions. The reliability of such relations, and of flow estimates made from them, are partly dependent on the user's ability to recognize a suitable reach and the reference levels in that reach. A test was made in northern Wyoming, U.S., to determine how consistently trained individuals could measure channel size for three different reference levels. Seven participants independently visited 22 sites and measured channel dimensions in sections of their choosing. Assuming the functional relation between a discharge characteristic (Q) and channel width (W) is log Q = f(1.5 log W), and that the average log W from seven measurements is the best estimate of log W at a site, an average standard error for discharge of about 30% was attributed to differences in width measurements alone. Author (ESA)

N78-11478# World Meteorological Organization, Geneva (Switzerland).
EXPERIENCE IN THE INSTALLATION AND OPERATION OF A NETWORK IN TROPICAL CONDITIONS
A. Arriagada, E. Basso, and H. Neira *In its* Mod. Develop. in Hydrometry, Vol. 2 1976 p 320-334 refs Prepared jointly with UN Develop. Program (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

Experiences of the Central American Hydrometeorological Project in the installation and operation of a large hydrological and meteorological network in the Central American Isthmus (Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama) are described. The special circumstances which affect the network design and implementation in isolated tropical areas are discussed. The results of operating several types of hydrometric equipment are discussed and some details are given on the methods used for flow and sediment measurements. Some recommendations on equipment and procedures to be used in areas with climates and/or access problems, are given.
Author (ESA)

N78-11479# Geological Survey, Menlo Park, Calif.
MEASUREMENT OF PULSATING DISCHARGE DURING FLASH FLOODS
Saul E. Rantz *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 335-342 refs (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

The rapidly changing discharge that occurs during flash floods in steep channels is often pulsating, that is, the longitudinal profile of the flow is marked by a series of abrupt translatory waves, commonly referred to as roll waves or slug flow. Determination of the discharge of pulsating flow requires: computation of the discharge in the overriding waves; and computation of the discharge in the shallow-depth, or overrun, part of the flow. The sum of the two discharges is the total discharge at the time of observation. To compute the discharge in an overriding wave the dimensions of the wave are observed and its computed volume is divided by the elapsed time between the arrival of waves. To compute the discharge in the shallow-depth, or overrun, part of the flow, the observed cross-sectional area of the shallow-depth flow is multiplied by its measured or computed velocity. Author (ESA)

N78-11480# State Hydrological Inst. (USSR).
AERIAL METHODS OF MEASURING WATER DISCHARGES
Vsevolod V. Kuprianov *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 343-350 refs (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

Methods of measuring water discharges with the help of an airplane have been under development in the U.S.S.R. since 1965. By now no less than 4,000 measurements have been carried out at the rivers in hard-to-access areas, where the usage of routine methods is difficult. There were methods of stream surface velocities determination by means of floats and velocity integration along the vertical. The accuracy of aerial water discharge measurements if carefully carried out is not inferior to the accuracy of ground methods. This method is particularly advantageous in the case of a submerged flood plain, when ground measurements are practically impossible. The use of aerial methods affords the possibility of reducing or even eliminating ground measurements. Author (ESA)

N78-11481# Geological Survey, Bay Saint Louis, Miss.
AUTOMATED GAGING OF STREAMFLOW AT CONTROL STRUCTURES
Dannie L. Collins and H. O. Wires *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 351-370 refs (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

A procedure has been developed by the U.S. Geological Survey for computing continuous streamflow records at multipurpose control structures on highly-regulated streams. Instrument packages and calibration techniques were developed for gate flow, turbine flow, fixed-spillway flow, lockage flow, and crest-gate flow. The coefficient relations are developed from measurements of discharge and other pertinent field variables. The generalized software computation package requires the coefficient relations along with field recorded variables, including headwater, tailwater, gate openings, turbine-scroll-case pressure differentials, number of lockages, and number of crest gates open. The field variables are sequentially recorded on punched paper tape by a digital data collection system using shaft position encoders and a special digital recorder. Author (ESA)

N78-11482 Geological Survey, Minneapolis, Minn.
THE SENSITIVITY OF SUSPENDED SEDIMENT GAGES
John V. Skinner and Joseph P. Beverage *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 375-388 refs (For availability see N78-11455 02-43)
Copyright. HC A22/MF A01; WMO, Geneva

The lower and upper concentration limits of detection of several types of suspended-sediment gages are reviewed and compared with concentrations found in rivers. For continuous monitoring, low-angle forward light-scattering in the Fraunhofer zone has considerable potential; however, this technique is new and will require further evaluation. The measurement of annual suspended-sediment load is examined in detail for 13 rivers in the U.S. Monitoring only near-peak concentrations is shown to be adequate to determine the annual sediment discharge of the majority of these rivers. Several available instruments are shown to have capabilities for this monitoring. Author (ESA)

N78-11483# Department of the Environmental Water Data Unit, Reading (England).
THE EFFECT OF PULSATIONS IN FLOW ON THE MEASUREMENT OF VELOCITY
Reginald W. Herschy *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 389-403 refs (For availability see N78-11455 02-43)
Copyright. Avail: NTIS HC A22/MF A01; WMO, Geneva

The effects of pulsations in the flow on the accuracy of velocity measurements were investigated. Up to 40 current meters on 8 verticals were operated simultaneously over a continuous period of 24 h at each of 3 river sites. The computed uncertainties

were plotted against corresponding point velocities and the relations tabulated for exposure times of 30 sec, 1 min, 2 min, and 3 min. It was found that the uncertainties in velocity due to pulsations were related to both depth and velocity and were highest at low velocities and lowest at high velocities no matter what position in the vertical these velocities occurred. Uncertainties were expressed at the 95% confidence level and varied from 5 % for an exposure time of 3 min and a velocity of 0.3 m/s to 80% for an exposure time of 30 sec and a velocity of 0.05 m/s. Since the equation for the estimation of the uncertainties in a single determination of discharge randomizes the contributing uncertainties, it is suggested that the tabulated values are suitable for general application for similar rivers. Author (ESA)

N78-11484# Ministere de l'Agriculture (France).
COMPARATIVE LABORATORY TESTS OF PNEUMATIC WATER LEVEL RECORDERS
In WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 408-413 (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

The purpose of these tests is to determine the capacity (in every sense of the word) of a water level recorder to represent the water level at any instant. Since 1972, two pneumatic apparatus of different makes have been tested at a gaging station in south west France. Their respective responses to water level variations showed unaccountable divergences. A series of comparative laboratory tests was then decided on and carried out in 1973 and 1974. Subsequent to these tests, the WMO launched an international comparison program among the principal hydrological devices. The tests required by the WMO are not identical to those of the present study, which are intended to analyze the reactions of pneumatic water level recorders now marketed in France, due to different site conditions (position of the pressure pick up) and different types of water level evolutive conditions, as found on French rivers. Author (ESA)

N78-11485# Research Inst. for Water Resources Development, (VITUKI), Budapest (Hungary).
EXPERIENCES GAINED DURING THE INVESTIGATION OF INTERCOMPARISON OF CURRENT METERS
Laszlo Muszkalay *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 414-427 (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

The purpose of intercomparison tests is to ensure the uniformity of data on various current meter instruments throughout the world and to minimize the measurement errors. In the interest thereof, specification data sheets, methods of measurement, and measurement data sheets have been compiled on the basis of considerations explained and supported by examples. An international instrument testing project could thus be realized by observing uniform principles. Attention is paid to the errors of measurement introduced by differences in the calibration and field-use conditions of the instruments, owing to which the results obtained with different instrument types also display differences. Author (ESA)

N78-11486# Research Inst. for Water Resources Development, (VITUKI), Budapest (Hungary).
A WATER STAGE AND QUALITY MONITORING SYSTEM CONNECTED TO TELEX NETWORK
B. Berke and L. Palos *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 438-443 refs (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

A complex measuring station for observing water levels and water quality parameters of water courses was constructed. Its measured data are transmitted through the telex network of the post. In order to ensure connection between the measuring equipments and the telex network, an interface unit, called TELEXDAT, was developed that performs the most necessary functions of the well-known teletype. It senses the call and keeps the answer-back signs in its fix memory, that is, the information necessary for the identification of the station. It sends the latter together with the measured data whenever it is called. The fixing of the time of the call is secured by a built-in clock. On the calling side, the teletype writes the data in a tabulated form or fixes them on a punchtape. Author (ESA)

N78-11487# Water Authority, Budapest (Hungary).
ZAGYVA-TARNA WATER MANAGEMENT CONTROL SYSTEM
A. Karolyi, C. Karolyi, R. Radvanyi, A. Salamin, and E. Selenyi (Tech. Univ. of Budapest) *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 444-457 (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

The demand for information in the water sector has increased significantly in the last decade. Since the present gaging network is unsuited to satisfy the intensifying requirements, it has become necessary to develop a country-wide, up-to-date, automatic information-collecting network able to satisfy this need now and in the future. In the country's setup, as a first link, a water management system will be developed on the catchment area of the Zagyva and Tarna rivers, operating experimentally; in contrast to the traditional hydraulic data-collecting systems, this system will permit immediate processing and quick accessibility at the stocking of data, collected automatically, accurately, adequately, and with the utmost dispatch. Author (ESA)

N78-11488# Universite Catholique de Louvain (Belgium). Dept. of Agricultural Engineering.
APPLICATION OF TELEMEASUREMENT BY PUBLIC TELEPHONE NETWORK TO RIVER MODELING AND RIVER FLOW FORECASTING
E. Persoons, Gisele Bazier, J. C. Rouvet, and S. Musch *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 461-475 refs (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

One application of the LGR (Laboratoire de Genie Rural) telemeasurement system, through the public telephone network, to the forecasting of river flow is discussed. The system, developed by the Agricultural Engineering Dept. of the Universite Catholique de Louvain, which admits two recording possibilities, either to a teletype or to a computer, is presented. A model and field telemeasurement data in real time are given for a river basin of 752 sq km. This model is composed of two parts: a model I relating the net rain fall to the measured rainfall, and a model II, relating the net rainfall and the forecasted discharge at the outlet of the basin. The study of real time flow forecasting in the Dyle basin has been rendered possible with the help of telemeasurement through the public telephone network. Author (ESA)

N78-11489# Geological Survey, Reston, Va.
USE OF EARTH SATELLITE TECHNOLOGY FOR TELEMETERING HYDROMETEOROLOGICAL STATION DATA
Richard W. Paulson *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 476-489 refs (For availability see N78-11455 02-43)
Avail: NTIS HC A22/MF A01; WMO, Geneva

Recent developments in communications and earth satellite technologies are presenting new and powerful tools for the collection of hydrometeorological station data. It is now possible, using existing technologies, to deploy an earth satellite system to collect hydrometeorological data from a large network of stations distributed over continental or global areas. Experiments for the last 3 years with the LANDSAT series of polar orbiting satellites have demonstrated that data can be collected via inexpensive battery operated radios several times daily from 1,000 to 2,000 stations distributed over North America. The Geostationary Operational Environmental Satellites, two of which are in orbit, are designed to collect data from 10,000 stations. Existing technology can permit the collection of data from 100,000 stations deployed globally. Earth satellites can become powerful tools for collecting data related to changes in the environment and for monitoring the status and performance of data gathering networks. The hydrometeorological communities are faced with the challenge to develop water resources management and forecasting techniques to fully realize the benefits earth satellites can provide. Author (ESA)

N78-11490# Inland Waters Directorate, Ottawa (Ontario). Water Resources Branch.
DATA RETRANSMISSION BY SATELLITE FOR OPERATIONAL PURPOSES
R. A. Halliday *In* WMO Mod. Develop. in Hydrometry, Vol. 2 1976 p 490-501 refs (For availability see N78-11455 02-43)

Avail: NTIS HC A22/MF A01; WMO, Geneva

It is not economically possible to telemeter water resources data from many parts of Canada using conventional telephone or radio systems. Because of this, experimental use of the LANDSAT data retransmission system was initiated in 1972. Since that time both the LANDSAT and GOES spacecraft have been used to retransmit water level and other related data for operational purposes. The retransmitted data have been used for flow and flood forecasting and for hydrometric operations. The satellite data collection systems have operated so well and the costs of using the system have been so favorable that a considerable expansion of the network seems likely. There is also a good possibility that a data retransmission system using Canadian UHF satellites will be implemented. Author (ESA)

N78-11491# Naval Oceanographic Office, Washington, D. C.
AERIAL ICE RECONNAISSANCE AND SATELLITE ICE INFORMATION MICROFILM FILE 1976, SUPPLEMENT 1
Peter A. Mitchell May 1977 17 p refs
(AD-A043046; NOO-RP-17(76)-Suppl-1) Avail: NTIS HC A02/MF A01 CSCL 08/12

Between 1953 and 1974 the Naval Oceanographic Office (NAVOCEANO) presented historical synoptic ice data gathered during U.S. Navy, U.S. Coast Guard, and Danish polar operations conducted from 1952 through 1971 in its annual reports of both the Arctic and Antarctic ice observing and forecasting programs (Naval Oceanographic Office, 1953-1974). These publications provided in chart form ice conditions observed by aerial reconnaissance and interpreted from satellite imagery for the eastern and western sectors of the North American Arctic and in selected portions of the seas surrounding the Antarctic Continent. These series of reports terminated with the 1969 and 1971 annual reports for the Antarctic and Arctic, respectively. This supplement lists all available microfilm imagery of ice data gathered and subsequently added to the Aerial Ice Reconnaissance and Satellite Ice Information Microfilm File during calendar year 1976. GRA

N78-11492# Texas Technological Univ., Lubbock. Dept. of Range and Wildlife Management.
MONITORING OF FOREDUNES ON PADRE ISLAND, TEXAS
Bill E. Dahl and John P. Goen Jul. 1977 70 p refs
(Contract DACW72-75-C-0011)
(AD-A043875; CERC-MR-77-8) Avail: NTIS HC A04/MF A01 CSCL 13/2

This study was conducted to continue monitoring foredunes formed from grass plantings made during 1969 to 1973 on north Padre Island beaches. The report summarizes data obtained from elevational profiles and vegetative transects at four experimental foredune sections and one natural foredune section during 1975 and 1976. The beach and foredunes, a 655-foot cross section, gained 5.7 cubic yards per linear foot of beach from August 1975 to August 1976. However, sand accumulation was not uniform; the north end of the study area gained no sand. Plantings, 50 feet wide seaward of existing foredunes proved to be an effective dune-widening technique. This has provided a 125-foot dune base versus an 80-foot dune base from initial 100-foot-wide plantings. Sand-trapping rates averaged 6.3 cubic yards per linear foot per year on foredunes of experimental plantings versus 4.0 cubic yards for the unplanted, natural area. However, accumulation rates for the last year for planted and natural foredunes were almost identical. Apparently, the natural area is sufficiently vegetated to accumulate sand as rapidly as planted areas, but it has taken 15 years to reach this trapping efficiency and without a recognizable dune line. Rate of lateral grass spread from initial plantings varied from 5.25 to 7.24 ft/yr. GRA

N78-11493# Coastal Engineering Research Center, Fort Belvoir, Va.
LABORATORY EFFECTS IN BEACH STUDIES. VOLUME 1. PROCEDURES USED IN 10 MOVABLE-BED EXPERIMENTS
Robert P. Stafford and Charles B. Chesnutt Jun. 1977 68 p refs
(AD-A043870; CERC-MR-77-7) Avail: NTIS HC A04/MF A01 CSCL 08/3

Procedures developed and conditions existing during 10 experiments on Laboratory Effects in Beach Studies (LEBS) are contained in this volume as a convenient reference to the analyses of LEBS data reported in separate volumes. This report also serves as a procedural manual for a common type of coastal engineering experiment, and it describes the wave generators used to produce data published in previous reports by the Coastal Engineering Research Center (CERC). Special attention is given to the problem of running movable-bed experiments in outdoor facilities. Recordkeeping, construction of initial profile, water level control, wave height measurement, analysis of wave envelopes, ripple effects on profile accuracy, temperature measurement, and observation of breakers and currents are also discussed.
Author (GRA)

N78-11494# Geological Survey, Denver, Colo.
DERIVATION OF EQUATIONS DESCRIBING SOLUTE TRANSPORT IN GROUND WATER Final Report
Leonard F. Konikow and David B. Brove Apr. 1977 36 p refs
(PB-268874/5; USGS/WRI-77/19; USGS/WRD/WRI-77/037)
Avail: NTIS HC A03/MF A01 CSCL 13B

A general equation describing the three-dimensional transport and dispersion of a reacting solute in flowing ground water is derived from the principle of conversion of mass. The derivation presented in this report is more detailed but less rigorous than derivations published previously. The general solute-transport equation relates concentration changes to hydrodynamic dispersion, convective transport, fluid sources and sinks, and chemical reactions. Because both dispersion and convective transport depend on the velocity of ground-water flow, the solute-transport equation must be solved in conjunction with the ground-water flow equation. GRA

N78-11495# General Accounting Office, Washington, D. C. Community and Economic Development Div.
WATER RESOURCES PLANNING, MANAGEMENT, AND DEVELOPMENT: WHAT ARE THE NATION'S WATER SUPPLY PROBLEMS AND ISSUES?
28 Jul. 1977 58 p
(PB-270171/2; CED-77-100) Avail: NTIS HC A04/MF A01 CSCL 13B

The focus of the water and water-related programs area is on those programs and activities concerned with water resources planning, management, and development projects designed to provide adequate water supplies to meet present and future demands. Water resources planning encompasses assessing the quantity and quality of available water supplies, forecasting future water demands, analyzing existing and potential water supply problems, and preparing proposals for resolving such problems. GRA

N78-11496# Netherlands Interdepartmental Working Group on the Application of Remote Sensing, Delft.
EVALUATION OF AN INFRARED LINE SCANNER FOR THE STUDY OF COASTAL WATER CIRCULATION [EVALUATIE INFRARED LINE SCANNER VOOR ONDERZOEK KUSTWATER-CIRCULATIE]
H. W. BrunsveldvanHulten (Rijkswaterstaat) and C. Kraan (Roy. Neth. Meteorol. Inst.) Jan. 1977 88 p refs In DUTCH; ENGLISH summary
(NIWARS-Publ-41) Avail: NTIS HC A05/MF A01

Research on the application of infrared techniques in studies on coastal water circulation is reported. Results with an airborne infrared line scanner (IRLS) and infrared thermometer (IRT) are presented. In addition to some instrumentational characteristics, interpretation of measurements and data processing techniques are mentioned. It is shown that such techniques may contribute substantially to the knowledge on water circulation processes. Detailed information, especially from IRLS, is obtained. The usefulness of such techniques for different studies is mentioned. It is shown that temperature measurements in general are realistic but studies on the radiation temperature and phenomena in the air-sea boundary layer, e.g., emissivity coefficient, are necessary in order to make this technique reliable. Author (ESA)

N78-11497# International Institute for Applied Systems Analysis, Laxenburg (Austria).

SENSITIVITY ANALYSIS OF STREETER-PHELPS MODELS
S. Rinaldi (CNR, Milan) and R. Soncini-Sessa (CNR, Milan) Feb. 1977 22 p refs Sponsored in part by CNR
(IIASA-RR-77-1) Avail: NTIS HC A02/MF A01

The sensitivity theory was applied to a class of generalized Streeter-Phelps models in order to predict the variations induced in BOD by the variations of some parameters characterizing the river system. It is shown how simple and elegant this technique is and, at the same time, it is proved that many relatively complex phenomena can be explained by Streeter-Phelps models. Author (ESA)

N78-11498# Central Intelligence Agency, Washington, D.C. Office of Geographic and Cartographic Research.
CAM-CARTOGRAPHIC AUTOMATIC MAPPING PROGRAM DOCUMENTATION, 5TH EDITION
Jun. 1977 138 p Supersedes BGI-D-75-1
(PB-270304/9; GC-77-10126; CIA/DF-77/006A; BGI-D-75-1) Avail: NTIS HC A07/MF A01 CSCL 08B

CAM is an IBM System/360 Fortran level H or G and Assembly Language Code (ALC) program that performs a wide variety of cartographic functions. Included are 16 map projections, the Universal Transverse Mercator (UTM) grid system, and an XY (One for One) data display routine. CAM connects points with straight lines or circles, and draws line grids, range rings, ellipses, cones, symbols, azimuths and elevation rings. Included is a World Coastline file of 8200 points, but CAM is also used in conjunction with World Data Bank I, a 100,000 point file separately contained on Accession No. PB-223 178. A significant new feature of CAM-5th Edition also allows its use in conjunction with World Data Bank II, which contains approximately 6 million points. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N78-11499*# National Aeronautics and Space Administration, Washington, D. C.
FORMATION OF STORED HEAT BY MEANS OF BLED STEAM DURING TIMES OF LOAD REDUCTION AND ITS USE IN PEAK LOAD TIMES
E. Bitterlich Oct. 1977 42 p refs Transl. into ENGLISH from Technische Mitt. (West Germany), v. 60, no. 9/10, Sep./Oct. 1976 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Deutsche Babcock, Ltd., Oberhausen (West Germany)
(Contract NASw-2790)
(NASA-TM-75147) Avail: NTIS HC A03/MF A01 CSCL 10B

Technical possibilities and economic advantages of integrating hot water storage systems into power plants fired with fossil fuels are discussed. The systems can be charged during times of load reduction and then used for back-up during peak load periods. Investment costs are higher for such systems than for gas turbine power plants fired with natural gas or light oil installed to meet peak load demand. However, by improving specific heat consumption by about 1,000 kcal/k ohm, which thus reduces the related costs, investment costs will be compensated for, so that power production costs will not increase. Author

N78-11500*# National Aeronautics and Space Administration. Pasadena Office, Calif.
IMPROVED SOLAR PHOTOLYSIS OF WATER Patent Application
Porter R. Ryason, inventor (to NASA) (JPL) Filed 30 Sep. 1977 18 p
(Contract NAS7-100)
(NASA-Case-NPO-14126-1; US-Patent-Appl-SN-838336) Avail: NTIS HC A02/MF A01 CSCL 10A

A cyclic process for the solar photolysis of water was developed. The process includes a first stage in which water is reduced in the presence of a Eu(+2) photo-oxidizable reagent producing hydrogen and spent oxidized Eu(+3) reagent. The spent reagent is reduced by means of a transition metal liquid complex reductant, RuL(+3) in a photoexcited state, such as a ruthenium pyridyl complex. Due to competing reactions between the photolysis and regeneration products, the photo-oxidation reaction must be separated from the regeneration in space and time by supporting the reagent and/or the reductant on solid supports and utilizing pH, wavelength and flow control to maximize hydrogen and oxygen production. NASA

N78-11501# Office of Naval Research, London (England).
EUROPEAN DEVELOPMENTS IN THE Na/S HIGH TEMPERATURE BATTERY FOR AUTOMOBILE PROPULSION AND ENERGY STORAGE
Abraham Sosin 13 Jun. 1977 18 p
(AD-A042541; ONRL-R-5-77) Avail: NTIS HC A02/MF A01 CSCL 10/3

The sodium-sulfur battery is a leading candidate for future use in the propulsion of automobiles, vans, buses, and trains and for energy storage and load-leveling by electrical utilities. This report presents a brief description of the fundamentals of the operation of the battery, with indication of some considerations which control its development into an important technological system. The status of the battery development in England, France and Germany is then reviewed. Author (GRA)

N78-11502# Air Force Academy, Colo. Frank J. Seiler Research Lab.
HIGH ENERGY DENSITY PELLETIZED ALUMINUM CHLORIDE THERMAL BATTERIES. PART 2: CATHODE SCREENING Technical Report, Jan. 1976 - Apr. 1977
John C. Nardi, John K. Erbacher, and Charles L. Hussey Apr. 1977 31 p refs
(AD-A043659; FJSRL-TR-77-0004-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 10/3

Pelletized single cell experiments have been conducted to develop a family of potential cathode for a new, low temperature thermal battery system. The cells utilize a 60.2 a/o lithium-aluminum alloy anode and a molten salt electrolyte of NaCl-saturated AlCl3. They operate at temperatures between 175 and 250 C. A total of 40 sulfides, oxides, and halides were evaluated and compared to the molybdenum (V) chloride and copper (II) chloride cathodes previously studied. Of this group, three halides, WCl6, FeCl3, and TeCl4, exhibited long discharge lifetimes, high available energy density, and high voltages under load. Various brands of graphite, acetylene black, and various types of metallic current collectors also were evaluated for performance enhancement. Author (GRA)

N78-11503# Boston Univ., Mass.
PHOTOCHEMICAL CONVERSION OF SOLAR ENERGY Annual Progress Report, 1 Jan. - 31 Dec. 1976
Norman D. Lichtin 31 May 1977 70 p
(Grant NSF AER-72-03579-A05)
(PB-270058/1; NSF/RA-770145) Avail: NTIS HC A04/MF A01 CSCL 07E

Basic and applied aspects of thin-layer, totally-illuminated (TI-TL) iron-thiazine photogalvanic cells were investigated. I(sc) varies linearly with photostationary concentration of leucodye. Cyclic voltammetry shows that electron transfer between the thionine-leucothionine (TH(+)/TH4(+2) couple and SnO2 is kinetically controlled, rectification reduces the efficiency of oxidation of TH4(+2), the mechanism is EE and the process is more nearly reversible in neat H2O than in 50 v/v% aq CH3CN. The SnO2 electrode is highly irreversible to Fe(+3)/Fe(+2); oxidation of Fe(+2) is particulary inhibited. Fe(+3)/Fe(+2) is more reversible at SnO2 in 50 v/v% aq CH3CN than in water. TH4(+2) is strongly and TH(+) is weakly adsorbed at SNO2. E(0) for TH(+)/TH2(+) and TH2(+)/TH4(+photostationary state decay rate together with EFB data to determine the energy diagram for the interface between SNO2 and iron-thionine solutions. GRA

N78-11504# Thermo Electron Corp., Waltham, Mass.
ERDA/NASA ADVANCED THERMIONIC TECHNOLOGY PROGRAM Progress Report
Feb. 1977 32 p refs
(Contract EY-76-C-02-3056)
(COO-3056-20; PR-20) Avail: NTIS HC A03/MF A01

Progress is reported in the areas of surface studies (surface theory and activation chamber experiments), plasma studies (converter theory and enhanced mode conversion experiments), converter development (low temperature conversion experiments and high efficiency conversion experiments), and component hardware (hot shell development). ERA

N78-11505# Warren Spring Lab., Stevenage (England).
ENERGY CONSIDERATIONS IN ELECTROHYDROMETALLURGY
Renato G. Bautista and Douglas S. Flett 1976 21 p refs Presented at 69th Meeting of the AICHE, Chicago, 28 Nov. 1976
(Contract W-7405-eng-82)
(IS-M-83; Conf-761109-12; LR-221(FE);
ISBN-0-356240-70-2) Avail: NTIS HC A02/MF A01

Factors affecting energy consumption in electrohydrometallurgical processes are reviewed. It is shown that increasing the throughput of electrolytic cells requires increasing electrical energy consumption per unit weight of product but a reduction in heating requirements results. For high current density electrowinning considerable modification to the hydrodynamic conditions in the cell is necessary and suggested methods are discussed. ERA

N78-11506# Energy Research and Development Administration, Washington, D. C. Div. of Solar Energy.
SOLAR PROGRAM ASSESSMENT: ENVIRONMENTAL FACTORS. FUEL FROM BIOMASS
Mar. 1977 144 p refs
(ERDA-77-47/7) Avail: NTIS HC A07/MF A01

The major environmental issues associated with the further development of biomass production and biomass conversion systems are presented and evaluated with respect to priority. The basic concepts of the technology are reviewed, as are resource requirements. The potential effects of this technology on the full range of environmental concerns (i.e., air and water quality, biosystems, safety, social/institutional structures, etc.) are then discussed in terms of both their relative significance and possible solutions. Only those impacts unique to the solar portion of the technology are discussed in depth. An environmental work plan is presented, listing research and development proposals and a NEPA work plan, which might help clarify and/or alleviate specific environmental problems. ERA

N78-11507# Lockheed Missiles and Space Co., Sunnyvale, Calif.
OCEAN THERMAL ENERGY CONVERSION (OTEC) TEST FACILITIES STUDY PROGRAM, VOLUME 1
17 Jan. 1977 496 p refs
(Contract EY-76-C-03-1156)
(SAN/1156-77/1-Vol-1; LMSC-D506781-Vol-1) Avail: NTIS HC A21/MF A01

Alternative non-site specific OTEC test facilities/platform requirements for an integrated OTEC test program including both land and floating test facilities were studied. A progression of tests were established in which OTEC power cycle component designs proceeded through advanced research and technology, component, and systems test phases. This progression leads to the first OTEC pilot plant and provides support for following developments which potentially reduce the cost of OTEC energy. It also includes provisions for feedback of results from all test phases to enhance modifications to existing designs or development of new concepts. Emphasis is placed on defining the test facility which is capable of supporting the spectrum of tests envisioned. All test support facilities and equipment were identified and included in terms of space, utilities, cost, schedule, and constraints or risks. ERA

N78-11508# Oak Ridge National Lab., Tenn.
TRANSPORTATION ENERGY CONSERVATION DATA BOOK, SUPPLEMENT-3
A. S. Loebl May 1977 158 p refs
(Contract W-7405-eng-26)
(ORNL-5248) Avail: NTIS HC A08/MF A01

This series of documents is intended to provide a desk-top reference for use by the Transportation Energy Conservation Division of the Energy Research and Development Administration. The supplements contain statistics that expand and refine data presented in edition one. A variety of tables, charts, maps, and graphs is used in this volume to present statistical data on energy use and energy-related activity in the transportation sector. A major aspect of the data in this supplement focuses on energy supply to the transportation sector. Data on characteristics of transportation modes, fuel consumption characteristics, and conservation alternatives are also included and serve to augment and update information presented in edition one. The glossary represents a significant expansion. A list of references is provided, an index, and an annotated bibliography (showing recent acquisition) are included. ERA

N78-11509# Sandia Labs., Albuquerque, N. Mex.
DIAGNOSTIC ASSESSMENT FOR ADVANCED POWER SYSTEMS Interim Report
H. W. Coleman, D. R. Hardesty, and R. J. Cattolica Mar. 1977 116 p refs Prepared for advanced Power Systems Branch, ERDA/Fossil Energy
(Contract EY-76-C-04-0789)
(SAND-77-8216) Avail: NTIS HC A06/MF A01

Diagnostic techniques needed to characterize the flow at the combustor exit and turbine inlet in advanced, open-cycle gas turbine systems that will be used for stationary power generation are reviewed. Problem areas that are inherent in such systems are identified. For purposes of initially defining diagnostics requirements, two different advanced stationary power gas turbine systems are considered. System one is a low turbine inlet temperature system with high ash carry-over into the turbine, and system two is a high turbine inlet temperature system fired with a clean liquid or gaseous coal-derived fuel or incorporating an efficient interstage gas-cleanup system. Estimates of the properties of the turbine inlet flows to be expected in these systems are presented and serve as a basis from which the discussion of diagnostic techniques proceeds. Diagnostic techniques for the determination of particulate size distribution, particulate mass loading density, gas velocity, gas temperature, and species concentrations are discussed. ERA

N78-11510# National Physical Lab., Teddington (England).
INDUSTRIAL ENERGY THRIFT SCHEME Progress Report, 1 Jan. - 30 Sep. 1976
Apr. 1977 33 p
(NPL-Chem-68-Pr-1) Avail: NTIS HC A03/MF A01

The progress made during the first nine months of the industrial energy thrift scheme is summarized. The scheme was initiated in 1976 by the Department of Industry to promote the more efficient use of energy by U. K. industry. The scheme is also designed to gather information both on energy-saving opportunities and on the need for further R and D directed towards the improvement of energy utilization. The planning and organization of the scheme was carried out by the Department's Energy Unit in the Chemical Standards Division of the NPL. The Energy Unit is also responsible for the overall management of the scheme and for ensuring that the results are applied to the benefit of industry. Author (ESA)

N78-11511# International Institute for Applied Systems Analysis, Laxenburg (Austria).
AN ALGORITHM FOR CONSTRAINED OPTIMIZATION WITH SEMISMOOTH FUNCTIONS
R. Mifflin Feb. 1977 36 p refs
(Grant AFOSR-74-2695)
(IIASA-RR-77-3) Avail: NTIS HC A03/MF A01

Large-scale optimization models appear in many areas of application at IIASA. For example, such models are useful for estimating the economic value of introducing solar and wind generated electrical energy into an existing power grid and for determining equilibrium prices for agricultural commodities in international trade as a function of national policies. Certain methods of decomposition for solving such optimization problems require the solution of a relatively small problem, the objective function of which is not everywhere differentiable. An implement-

able algorithm that can be used to solve such nonsmooth optimization problems is presented. Author (ESA)

N78-11512# Technische Univ., Berlin (West Germany). Sonderforschungsbereich Magnetohydrodynamik.
COMPARISON OF SEVERAL COMPUTATION METHODS FOR INDUCTIVE MHDCHANNEL AND FREE JET CONVERTERS WITH NONMAGNETIC LIQUID METALS AS WORKING FLUIDS [VERGLEICH VERSCHIEDENER RECHENVERFAHREN FUER INDUKTIVE MHD-KANAL- UND FREISTRAHLWANDLER MIT NICHTMAGNETISCHEN FLUESSIGEN METALLEN ALS ARBEITSMITTEL]
D. Djamali-Schahni Apr. 1976 23 p refs In GERMAN
(Contract BMFT-PLE-ET-4003-A)
(SFB-MHD-27) Avail: NTIS HC A02/MF A01

Several methods for calculating inductive MHD converters are summarized and compared. Various converter configurations were investigated: flat and aximmetric channel and free jet converters, quadrupole and dipole. The flat configuratıons are compared with the data of an MHD generator. The computer programs described take into account only the electrodynamics of the channel and project converter. The introduction of hydrodynamic aspects is proposed. ESA

N78-11513# International Research and Development Co. Ltd., Newcastle (England).
FATIGUE PROPERTIES OF SOLAR CELL INTERCONNECTORS
R. B. Evans, S. Stevens, and P. Campbell Jun. 1977 88 p
(Contract ESTEC-2479/75-HP)
(IRD-77/19; ESA-CR(P)-971) Avail: NTIS HC A05/MF A01

A test rig was developed to evaluate the fatigue properties of molybdenum and silver mesh solar cell interconnectors at temperatures of -130 C and -170 C. The rig consists of an electromagnetic vibrator and a specimen clamping system and is operated using a closed loop system of control. The molybdenum interconnectors contain a complex loop to provide flexibility. The effect of variations in loop height and configuration and in sheet thickness were difficult to evaluate and it is thought that properties were more influenced by the physical and metallurgical condition of the edges of the specimens. The silver mesh interconnector type varied in method of manufacture and in mesh strand width and configuration. The physical characteristics of the mesh varieties had little effect on fatigue properties, but mesh orientation was of importance. Author (ESA)

N78-11514# National Centre of Tribology, Risley (England). European Space Tribology Lab.
THERMAL VACUUM LIFE TEST OF AN HSD SOLAR ARRAY DRIVE (HSD NO. 2). FIRST TWO YEARS OF OPERATION
J. Gillies and R. B. Watters Paris ESA Mar. 1977 97 p
(Contract ESTEC-2584/75-MD)
(ESA-ESTL-23; ESA-CR(P)-989) Avail: NTIS HC A05/MF A01

A thermal vacuum life test at normal operating speed of a solar paddle drive mechanism is reported. The mechanism has run for two years to date with the shaft rotating at one revolution per day. During the test the radiator surrounding the mechanism has been held at a constant temperature of 22 C while the shaft temperature, at the array mounting flange, is changed at 6-monthly intervals so that it operates at either 10 C or 60 C. At the beginning of each 6-monthly cycle, 30 eclipse temperature cycles are carried out in which the shaft temperature is reduced from 60 C to - 20 C in 90 minutes and returned to 60 C. It is intended that the test will run for 7 years. Results are presented of the first two years running during which time the mechanism is shown to have operated within its specification limits. There has, however, been a progressive reduction in the torque required to turn the shaft. ESA

N78-11515# Maine Univ., Orono. Dept. of Electrical Engineering.
TERNARY COMPOUND THIN FILM SOLAR CELLS-2 Quarterly Report, 1 Jan. - 31 Mar. 1977
L. L. Kazmerski Apr. 1977 42 p refs Sponsored in part by ERDA
(Grant NSF AER-75-19576-A01)
(PB-270029/2; NSF/RA-770144; QR-2) Avail: NTIS HC A03/MF A01 CSCL 10B

The fabrication and performance of several vacuum deposited thin-film photovoltaic devices using 1-111-V12 chalcopyrite semiconductors are presented. The heterojunctions CdS/CuInS2 and CdS/CuInSe2 are described with measured solar-conversion efficiencies of 3.25% and 6.6% respectively. Little Photovoltaic response is observed in the CdS/CuInTe2 heterostructure. The photovoltaic effect in the first n,p CuInS2(3.6%) and n,p CuInSe2 (3.0%) thin-film homojunctions is demonstrated. Light and dark J-V characteristics, spectral responses and device parameters are reported for all these devices. Finally, the structure and stability of these ternary-based devices are examined. GRA

N78-11154*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Engineering Section.
A THERMODYNAMIC ANALYSIS OF A SOLAR-POWERED JET REFRIGERATION SYSTEM
F. L. Lansing and V. W. Chai *In its* The Deep Space Network 15 Oct. 1977 p 209-217 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 10A

N78-11156*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. TDA Planning Office.
DYNAMIC MODELING AND SENSITIVITY ANALYSIS OF SOLAR THERMAL ENERGY CONVERSION SYSTEMS
C. L. Hamilton *In its* The Deep Space Network 15 Oct. 1977 p 226-232 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 10A

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N78-11516 Wisconsin Univ., Madison.
DISPERSION OF ATMOSPHERIC POLLUTANTS IN FLOW OVER THE SHORELINE OF A LARGE BODY OF WATER Ph.D. Thesis
Ronald Joseph Dobosy 1977 172 p
Avail: Univ. Microfilms Order No. 77-14330

Simulation of pollutant dispersion and mixed layer development in a shoreline fumigation regime was studied using a two dimensional vertical plane model employing, depending on the experiment, level two or level three from the hierarchy of turbulence closure schemes of Mellor and Yamada. A one dimensional version of the model using hierarchy level three which includes nonlocal effects in the turbulence simulation was verified. Levels two and three were then compared using the two dimensional model under conditions as measured at Waukegan, Illinois. Predictions from level two, a simpler and purely local scheme, were comparable to level three for both pollutant concentration and mixed layer depth at least with winds about 3 m/s, except within 500 m of shore and for a short distance above the inversion base. Dissert. Abstr.

N78-11517*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH IN THE USE OF ELECTRETS IN MEASURING EFFLUENTS FROM ROCKET EXHAUST OF THE SPACE SHUTTLE (6.4 PERCENT SCALED MODEL) AND VIKING 1 LAUNCH
Michael Susko Nov. 1977 122 p refs
(NASA-TP-1073; M-231) Avail: NTIS HC A06/MF A01 CSCL 13B

Electrets used to detect the chemical composition of rocket exhaust effluents were investigated. The effectiveness of electrets was assessed while comparisons were made with hydrogen chloride measuring devices from chamber and field tests, and computed results from a multilayer diffusion model. The experimental data used were obtained from 18 static test firings, chamber tests, and the Viking 1 launch to Mars. Results show that electrets have multipollutant measuring capabilities, simplicity of deployment, and speed of assessment. The electrets compared favorably with other hydrogen chloride measuring devices. The summary of the measured data from the electrets

and the hydrogen chloride detectors was within the upper and lower bounds of the computed hydrogen chloride concentrations from the multilayer diffusion model. Author

N78-11518*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EXPERIMENTAL MEASUREMENTS OF THE GROUND CLOUD EFFLUENTS AND CLOUD GROWTH FOR THE MAY 20, 1975, TITAN 3C LAUNCH AT AIR FORCE EASTERN TEST RANGE, FLORIDA

Gerald L. Gregory and Richard W. Storey, Jr. Nov. 1977 93 p refs

(NASA-TM-74044; L-11699) Avail: NTIS HC A05/MF A01 CSCL 13B

The experiment included surface level and airborne in situ cloud measurements of the exhaust effluents from the Titan IIIC solid rocket boosters. Simultaneous visible spectrum photographic pictures of the ground cloud as well as infrared imaging of the cloud were obtained to study the cloud rise, growth, and direction of travel within the earth's surface mixing layer. The NASA multilayer diffusion model predictions of cloud growth, direction of travel, and expected surface level effluent concentrations were made prior to launch and after launch using measured meteorological conditions. Prelaunch predictions were used to position the effluent monitoring instruments, and the postlaunch predictions were compared with the measured data. Measurement results showed that surface level effluent values were low, often below the detection limits of the instrumentation. The maximum surface level hydrogen chloride concentration measured 50 parts per billion at about 8 km from the launch pad. The maximum observed in-cloud (airborne measurement) hydrogen chloride concentration was 7 per million. Author

N78-11519*# Duke Univ., Durham, N. C. Duke Environmental Center.

THE ENVIRONMENTAL ANALYSIS OF HELICOPTER OPERATIONS BY FEDERAL AGENCIES: CURRENT PROCEDURES AND RESEARCH NEEDS

Chandler C. Smith, Dennis B. Warner, and Jarir S. Dajani Aug. 1977 62 p refs

(Grant NsG-1121)

(NASA-CR-145238) Avail: NTIS HC A04/MF A01 CSCL 13B

The technical, economic, and environmental problems restricting commercial helicopter passenger operations are reviewed. The key considerations for effective assessment procedures are outlined and a preliminary model for the environmental analysis of helicopters is developed. It is recommended that this model, or some similar approach, be used as a common base for the development of comprehensive environmental assessment methods for each of the federal agencies concerned with helicopters. A description of the critical environmental research issues applicable to helicopters is also presented. Author

N78-11520*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SOME PHYSICAL AND THERMODYNAMIC PROPERTIES OF ROCKET EXHAUST CLOUDS MEASURED WITH INFRARED SCANNERS

Richard I. Gomberg, Andronicos G. Kantsios, and Frederick J. Rosensteel Nov. 1977 32 p refs

(NASA-TP-1041; L-11742) Avail: NTIS HC A03/MF A01 CSCL 13B

Measurements using infrared scanners were made of the radiation from exhaust clouds from liquid- and solid-propellant rocket boosters. Field measurements from four launches were discussed. These measurements were intended to explore the physical and thermodynamic properties of these exhaust clouds during their formation and subsequent dispersion. Information was obtained concerning the initial cloud's buoyancy, the stabilized cloud's shape and trajectory, the cloud volume as a function of time, and it's initial and stabilized temperatures. Differences in radiation intensities at various wavelengths from ambient and stabilized exhaust clouds were investigated as a method of distinguishing between the two types of clouds. The infrared remote sensing method used can be used at night when visible range cameras are inadequate. Infrared scanning techniques developed in this project can be applied directly to natural clouds, clouds containing certain radionuclides, or clouds of industrial pollution. Author

N78-11521# Teller Environmental Systems, Inc., N. Y.

ABATEMENT OF PARTICULATE EMISSIONS AND NOISE FROM JET ENGINE TEST CELLS INCLUDING REDUCTION OF GAS FLOW WITH THE TEST AUGMENTER SCRUBBER SYSTEM Final Report

Dec. 1971 131 p refs

(Contract N62467-70-C-0240)

(AD-A043255) Avail: NTIS HC A07/MF A01 CSCL 21/5

The prototype scrubber and augmentation system designed for and operated in Black Point Test Cell Number 1 NARF-Jacksonville has abated emissions to the projected design level. The engines operated with the system were the J-79, TF-30, and J-52. Particulate emissions were reduced to the 0.002-0.005 gr/SCF level. The visible emissions fell well within the Ringleman 1/2 level after dissipation of the steam plume. No fallout was evident during operation of the system. It was further established that engine test performance was not affected by the TESI system. The scrubber system was mounted on the exhaust stack of the cell thus obviating the necessity for costly ducting and the requirement for ground utilization. The size requirement of the scrubber was reduced significantly with the use of a new augmenter design that decreased the induced air to jet exhaust flow ratio from values in the range of 2:1 to 0.4-0.6:1. This new augmenter can reduce the augmentation even further, thus providing the potential of retrofit of existing cells to accommodate engines larger than now being tested. Sound levels were reduced by the installation of the scrubber from 6-10 decibels (dBA), where the original sound level was of the order of 90-95 dBA. GRA

N78-11522# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla.

POLLUTANT GENERATION BY AIR FORCE ELECTROPLATING PROCESSES Final Report, 1 Oct. 1974 - 1 Sep. 1976

Peter S. Daley Jun. 1977 38 p refs

(AD-A043266; CEEDO-TR-77-10) Avail: NTIS HC A03/MF A01 CSCL 13/2

A detailed study of the pollutants generated in Air Force electroplating was performed and pollution emission factors were recommended for a variety of electroplating operations. The largest single source of pollution in the plating operation was 'dragout', the material removed by parts when they are withdrawn from solution and rinsed. For chromium plating, aerosol generation at the plating solution surface was significant, amounting 0.12 g/A.da. This number was independent of a wide variety of electroplating variables and is recommended as an emission factor in chromium electroplating. Aerosol generation was not important in nickel, cadmium, or silver plating processes. Cyanide emissions in cadmium plating were independent of workload and depended primarily on tank surface area. An emission factor 10 g/sq m.da is recommended. Collateral studies of scrubber efficiency for scrubber collection of chromium aerosols, quantitation of the dragout problem, and potential savings through chromium overplate recovery are presented. Chromium is identified as the major pollution problem resulting from electroplating. Logic is presented that could lead to the exemption of Air Force electroplating operations from federal electroplating emission standards. Author (GRA)

N78-11523# California Univ., Riverside. Statewide Air Pollution Research Center.

CHEMICAL CONSEQUENCES OF AIR QUALITY STANDARDS AND OF CONTROL IMPLEMENTATION PROGRAMS: ROLES OF HYDROCARBONS, OXIDES OF NITROGEN AND AGED SMOG IN THE PRODUCTION OF PHOTOCHEMICAL OXIDANT Final Report, 1 Aug. 1973 - 30 Jun. 1974

James N. Pitts Jul. 1975 408 p refs

(Contract ARB-3-017)

(PB-269376/0; ARB-R-3-017-75-52) Avail: NTIS HC A18/MF A01 CSCL 07E

Development and validation of a surrogate mixture of hydrocarbons (HC), carbon monoxide and oxides of nitrogen (NO(x)) representative of the pollutant mix in the South Coast Air Basin of California (SCAB) was studied by 60 irradiation

experiments of 2,6 or 9-hour duration. Chemiluminescent NO-NO2 analyzers were shown to respond quantitatively, in the NO(x) mode, to nitrogen containing compounds including peroxyacetyl nitrate and organic nitrates and nitrites. The reactivities of selected aromatic hydrocarbons with the hydroxyl radical, a key intermediate species in photochemical smog, were measured. GRA

N78-11524# Research Triangle Inst., Research Triangle Park, N. C.
THE MEASUREMENT OF CARCINOGENIC VAPORS IN AMBIENT ATMOSPHERES
Edo D. Pellizzari Jun. 1977 304 p refs
(Contract EPA-68-02-1228)
(PB-269582/3; EPA-600/7-77-055) Avail: NTIS HC A14/MF A01 CSCL 07C

Analytical techniques and instrumentation, were evaluated for the collection and analysis of carcinogenic and mutagenic vapors occurring in ambient air. The areas of investigation included: (1) the development of a permeation system for delivering precise quantities of organic vapors for calibrating instruments, (2) the development of procedures for the preparation of glass capillary columns for effecting the resolution of complex atmospheric vapor mixtures, (3) the characterization of organic vapor emissions from preset controlled fires, and (4) the survey of ambient air samples taken at various sites around the continental U.S. for the detection of N-nitrosoamines. GRA

N78-11525# Ohio State Univ., Columbus.
APPLICATION OF FOURIER TRANSFORM SPECTROSCOPY TO AIR POLLUTION PROBLEMS, COMPUTER GENERATED LONG-PATH AIR SPECTRA
R. J. Nordstrom, J. H. Shaw, W. R. Skinner, J. G. Calvert, and W. H. Chan Mar. 1977 150 p
(Grant EPA-R-803868-1)
(PB-268992/5; EPA-600/3-77-026) Avail: NTIS HC A07/MF A01 CSCL 04A

An atlas of computer-generated infrared transmission spectra of the atmosphere for low humidity (29 percent relative humidity) and high humidity (65 percent relative humidity) air samples is presented. These spectra extend from 700/cm to 3000/cm, and were computed with a resolution of approximately 0.25/cm. The simulated path length is 3 km through an environment at 1013 mbar and 296 K. GRA

N78-11526# Ultrasystems, Inc., Irvine, Calif.
REDUCTION OF NITROGEN OXIDE EMISSIONS FROM FIELD OPERATING PACKAGE BOILERS, PHASE 3 Final Report, Jun. 1971 - Oct. 1976
M. P. Heap, C. McComis, T. J. Tyson, R. E. McMillan (Foster Wheeler Energy Corp.), R. E. Sommerland (Foster Wheeler Energy Corp.), and F. D. Zoldak (Foster Wheeler Energy Corp.) Jan. 1977 119 p
(Contract EPA-68-02-0222)
(PB-269277/0; EPA-600/2-77-025) Avail: NTIS HC A06/MF A01 CSCL 07A

Experimental investigations were carried out in a laboratory firetube boiler simulator, and an application program was conducted on two boilers operating in the field. The ultimate goal of the program was to determine if package boilers can operate in the field after modification to control NOx emissions without encountering practical problems. A 12 million Btu/hr firetube boiler and a 25 million Btu/hr heat output watertube boiler were modified to extract cooled combustion products from the stack and add them to the combustion air in the windbox. The effectiveness of FGR as a method of controlling NOx emissions was found to be dependent upon boiler type. It was effective in the firetube boiler: approximately 30% reduction in emissions was obtained with 40% recirculation. GRA

N78-11527# Environmental Monitoring and Support Lab., Research Triangle Park, N. C.
METHODOLOGY FOR MEASUREMENT OF POLYCHLORINATED BIPHENYLS IN AMBIENT AIR AND STATIONARY SOURCES, A REVIEW Final Report
John H. Margeson Apr. 1977 39 p refs
(PB-269350/5; EPA-600/4-77-021) Avail: NTIS HC A03/MF A01 CSCL 07C

The state of development of methodology for measurement of polychlorinated biphenyls (PCBs) in ambient air and stationary sources was reviewed. The most promising method for ambient air measurements involves collection of PCBs on polyurethane foam, extraction with an organic solvent, removal of interferences by column chromatography, and confirmation and analysis by electron-capture gas chromatography. Quantitation by perchlorination of PCBs to decachlorobipheny (DCB) is the most promising quantitation technique, but the procedure has not yet been perfected so the points are quantitatively converted to DCB. GRA

N78-11528# Central New York Regional Planning and Development Board, Syracuse.
EMISSIONS INVENTORY PROJECTIONS AND ALLOCATION PROJECTIONS TO SUB-COUNTY AREAS FOR THE SYRACUSE AIR QUALITY MAINTENANCE AREA Final Report, 1 Dec. 1975 - 15 Jun. 1976
15 Jul. 1977 79 p
(Contract EPA-68-02-2302)
(PB-269972/6; EPA-902/4-77-003) Avail: NTIS HC A05/MF A01 CSCL 13B

A disaggregated particulate matter emissions inventory suitable for use in both base year and projection year air quality dispersion modeling required for the Syracuse AQMA is presented. Allocations were made for population, transportation, commercial/institutional, industrial, and solid waste-based emissions. The results clearly indicate that the dominant sources of particulate emissions in Onondaga County are industrial process and fuel point sources. GRA

N78-11529# Envirex, Inc., Milwaukee, Wis. Environmental Sciences Div.
HANDLING AND DISPOSAL OF SLUDGES FROM COMBINED SEWER OVERFLOW TREATMENT. PHASE 1: CHARACTERIZATION Final Report, on Phase 1, Mar. 1973 - Feb. 1975
M. K. Gupta, E. Bollinger, S. Vanderah, C. Hansen, and M. Clark May 1977 203 p refs
(Contract EPA-68-03-0242)
(PB-270212/4; EPA-600/2-77-053a) Avail: NTIS HC A10/MF A01 CSCL 13B

A characterization and treatment feasibility test program was undertaken to develop optimum means of handling and disposal of residual sludges from Combined Sewer Overflows (CSO) treatment systems. Desk top engineering reviews were conducted to gather, analyze and evaluate pertinent information relating to pump/bleedback of the treatment residuals to the dry-weather sludge handling/treatment and disposal facilities. Characterization data including heavy metals and pesticides concentrations for eight CSO sludge residual samples collected across the nation are presented. Unit treatment process of centrifugation in conjunction with gravity or flotation thickening was concluded to be the optimum dewatering technique for on-site treatment of CSO residuals. GRA

N78-11530# General Accounting Office, Washington, D. C. Logistics and Communications Div.
DEPARTMENT OF DEFENSE AIR POLLUTION CONTROL: PROGRESS AND DELAYS
18 Jul. 1977 39 p
(PB-270115/9; LCD-77-305) Avail: NTIS HC A03/MF A01 CSCL 13B

The status of major Defense installations is discussed in relation to air quality standards and air control authorities. The information should be useful in gaging how clean air legislation is working in Federal facilities. GRA

N78-11531# Monsanto Research Corp., Dayton, Ohio.
SOURCE ASSESSMENT: OVERVIEW MATRIX FOR NATIONAL CRITERIA POLLUTANT EMISSIONS Final Report
E. C. Eimutis and R. P. Quill Jul. 1977 73 p
(PB-270100/1; MRC-DA-685) Avail: NTIS HC A04/MF A01 CSCL 13B

Stationary sources that emit criteria pollutants are listed. The overview matrix was prepared, using a computerized data base established for emissions of air pollutants from approximately 600 stationary source types in the combustion, organic materials,

inorganic materials, and open source categories. The matrix lists the total national emissions of criteria pollutants emitted by source type. (A source type is defined as a group of emission sources which have the same process and emission characteristics.)GRA

N78-11532# Central Inst. for Industrial Research, Blindern (Norway).
ANALYSIS OF POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
Alf Bjoerseth 21 Mar. 1975 17 p refs In NORWEGIAN; ENGLISH summary
(Contract NTNF-B-1550.4879)
(Rept-74-03-12; TR-1) Avail: NTIS HC A02/MF A01

A method is described for analyzing PAH in air samples from work atmosphere. The method is based on Soxhlet extraction of air filters by cyclohexane, liquid/liquid extraction with dimethylformanide: water (9 : 1) and back-extraction in cyclohexane, followed by gas chromatography. ESA

N78-11533# National Center for Scientific and Technical Documentation, Brussels (Belgium).
BOOKS ON AIR POLLUTION NOISE AND SOLID WASTES
1976 153 p refs
Avail: NTIS HC A08/MF A01

Over 1000 full references to books, monographs, and reports in the field of air pollution, noise, solid waste, and environmental legislation are given together with subject and author indexes. ESA

N78-11534# Royal Netherlands Meteorological Inst., De Bilt.
THE GAUSSIAN PLUME MODEL FOR THE CALCULATION OF HOURLY AVERAGE AIR POLLUTION CONCENTRATIONS [HET GAUSSISCHE PLUIMMODEL VOOR DE BEREKENING VAN UURGEMIDDELDE CONCENTRATIES VAN LUCHTVERONTREINIGING]
F. T. M. Nieuwstadt, P. A. T. Nieuwendijk, and C. A. Engeldal 1977 45 p refs In DUTCH; ENGLISH summary
(KNMI-WR-77-3) Avail: NTIS HC A03/MF A01

The Gaussian plume model computer program for the calculation of short term (hourly) averaged concentrations is presented. The model and its parameters were adapted as much as possible to the already existing model for long term averaged concentrations. Special problems in relation to the short term model were solved. Concentrations averaged over a period of three months, calculated with the long term and the short term model, were compared. Differences between the results of both models were acceptable. Author (ESA)

N78-11535# Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway).
OFFSHORE OIL POLLUTION
Terje Vassbotn 8 Apr. 1976 26 p refs In NORWEGIAN; ENGLISH summary
(Contract NTNF-B-1810.5205)
(STF21-A76054; ISBN-82-595-0813-3) Avail: NTIS HC A03/MF A01

A literature review on the subject of the impact of petroleum and petroleum products on the marine environment was the basis for estimation of the present (1975) and future (1980) oil pollution in the North Sea. The estimation is based mainly on crude oil consumption and future requirements in Norway, Denmark, Great Britain, West Germany, Belgium, and the Netherlands. The total mineral oil spillage in the North Sea was estimated at 1.1 million tons in 1975 and 0.62 million tons in 1980; however, offshore operations are only responsible for about 0.2% and 5% of the total spillage in 1975 and 1980, respectively. Author (ESA)

N78-11536# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands).
[ACTIVITIES OF THE TNO RESEARCH INSTITUTE FOR ENVIRONMENTAL HYGIENE] Annual Report, 1974-1975
[1976] 50 p refs
Avail: NTIS HC A03/MF A01

Various sections deal with water and soils, atmospheric pollution, indoor air pollution, indoor climate, sound lighting and isolation, housing, and living. ESA

N78-11537# California State Dept. of Transportation, Sacramento.
MINI-COMPUTER SOFTWARE DATA ACQUISITION AND PROCESS CONTROL SYSTEM FOR AIR POLLUTION MONITORING Interim Report
Walter A. Winter and Manoucher Farrockhrooz Sep. 1976 144 p
(Contract DOT-FH-11-7730)
(PB-270400/5; CA-DOT-TL-7080-3-76-39; FHWA-RD-76-145) Avail: NTIS HC A07/MF A01 CSCL 13B

An overview of the systems software and individual programs used to program a Hewlett Packard minicomputer to control the processes within a mobile air pollution monitoring laboratory and to acquire and store aerometric data is given. The mobile laboratories were constructed for use in microscale modeling studies along active highways. The appendix contains listings of the developed programs which were coded in Assembly language and FORTRAN. GRA

N78-11538# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
PARTICULATES AND AIR POLLUTION: AN ANNOTATED BIBLIOGRAPHY Final Report
Apr. 1977 102 p
(PB-270229/8; EPA-450/1-77-001) Avail: NTIS HC A06/MF A01 CSCL 13B

EPA's Office of Air Quality Planning and Standards has prepared, selected and compiled 400 abstracts on particulate emissions. The abstracts are arranged within 10 general subject categories. The abstracted documents are thought to be representative of available literature in this pollution category. Subject and author indices are included. The indices refer to the abstracts by a category code and abstract number. The author index lists all authors individually. Generally, higher abstract numbers have been assigned to more recent documents. GRA

N78-11539# Versar, Inc., Springfield, Va.
ASSESSMENT OF THE ENVIRONMENTAL AND ECONOMIC IMPACTS OF BAN IMPORTS OF PCBS Final Report
Robert P. Burruss, Jr. Jul. 1977 175 p refs
(Contract EPA-68-01-3259)
(PB-270225/6; EPA-560/6-77-007; Rept-474-5B) Avail: NTIS HC A08/MF A01 CSCL 13B

The uses of imported polychlorinated biphenyls for the maintenance of certain mining machinery are reported. In addition, PCBs are present as a significant impurity in polychlorinated terphenyls (PCTs) imported for use in investment casting waxes. Importation of PCBs for these uses will be banned after 1977 by the Toxic Substances Control Act, unless exemptions are allowed in accordance with the provisions of the Act. The recent Directive of the Council of the European Communities (EEC) prohibits use of PCBs and PCTs in investment casting waxes, but allows continued use of PCBs in mining machinery in Europe. GRA

N78-11540# Versar, Inc., Springfield, Va.
A FIRST ORDER MASS BALANCE MODELS FOR THE SOURCES, DISTRIBUTION AND FATE OF PCBS IN THE ENVIRONMENT Final Report
Frank C. Whitmore 27 Jul. 1977 180 p refs
(Contract EPA-68-01-3259)
(PB-270220/7; EPA-460/6-77-006; Rept-474-5G) Avail: NTIS HC A09/MF A01 CSCL 13B

A first order model for the sources, distribution and fate of PCBs in an aquatic system is described. The model is then applied to Lake Michigan and to the Great Lakes Systems. The results obtained from the model indicate that atmospheric sources are a major PCB input to the Great Lakes. Because of the great water mass of the lakes, the PCB concentration appears to be storage controlled rather than loss controlled. The major loss mechanisms are found to be co-evaporation from the airwater interface and entrapment with sediments. It is estimated that if all inputs for PCBs at Lake Michigan were eliminated, it would take more than 70 years for the concentration of PCBs in the water to decrease by 50 percent. GRA

N78-11541# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
COMPILATION OF AIR POLLUTANT EMISSION FACTORS, SUPPLEMENT NO. 7
Apr. 1977 121 p
(PB-270281/9; AP-42-Suppl-7) Avail: NTIS HC A06/MF A01 CSCL 13B

Revised and updated emissions data are presented for anthracite coal combustion fuel oil combustion, bagasse combustion in sugar mills, residential fireplaces, open burning, dry cleaning, storage of petroleum liquids, transportation and marketing of petroleum liquids, adipic acid, carbon black, charcoal, phthalic anhydride, feed and grain mills and elevators, fish processing, portland cement manufacturing, lime manufacturing, and acid sulfite pulping. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N78-11542 Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE FRONT SIDE BOUNDARY LAYER OF THE MAGNETOSPHERE AND THE PROBLEM OF RECONNECTION
G. Haerendel, G. Paschmann, N. Sckopke, H. Rosenbauer, and P. C. Hedgecock (Imperial Coll., London) Aug. 1977 85 p refs Submitted for publication Sponsored partly by Brit. Sci. Res. Council
(Grant WRK-210)
(MPI-PAE/Extraterr-136) Avail: Issuing Activity

Further HEOS 2 plasma and magnetic field data obtained in the front side boundary layers of the magnetosphere are presented. They reveal that the low latitude extension of the entry layer is of somewhat different nature. The most pronounced difference with respect to the entry layer in the cusp region is the substantial density jump at the magnetopause. The low-latitude boundary layer tends to be thinner and less turbulent, and the flow velocity inside the layer is always lower than that of the adjacent magnetosheath. This observation excludes large-scale reconnection at the front of the magnetosphere as origin of the layer. It is suggested that diffusive entry of magnetosheath plasma and/or heating of detached plasma from the plasmasphere leads to the formation of the layer. It appears likely that reconnection is dominantly occurring as a transient process in the cusp region and accompanies the eddy convection inside the entry layer. As a consequence magnetic flux is being eroded from the front of the magnetosphere. This is in agreement with the signature of short-term large-amplitude magnetic perturbations observed in the lowlatitude boundary layer. Author (ESA)

N78-11543# Maine Univ., Orono.
A STUDY OF THE HEAT FLUX REVERSAL REGION UPSTREAM FROM THE EARTH'S BOW SHOCK, USING DATA FROM THE OGO 5 ELECTRON SPECTROMETER
Ph.D. Thesis
Donald Joseph Hei, Jr. Ann Arbor, Mich. Univ. Microfilms International, 1977 213 p refs
Avail: NTIS HC A10/MF A01

Interplanetary data from the OGO 5 electron spectrometer experiment were analyzed to understand the cause of non-monotonic spectral features at suprathermal energies. It was found that the source for these features has one terminus at the bow shock surface skirted by the interplanetary magnetic field. The source region termed the heat flux reversal region (HFR) was found to be approximately located at the boundary between connecting and missing field geometries. Plasma determined to be in the HFR was shown to have reduced magnetic field magnitude compared to data taken adjacent to it. This plasma also was shown to have perpendicular electron pressure within the average range expected for the solar wind. These results were explained in terms of an interaction occurring within the HFR involving suprathermal electrons which produced the reduced magnetic field magnitude and the regulated perpendicular pressure. Author

N78-11544*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STRATCOM-8 SCIENTIFIC OBJECTIVES AND MISSION ORGINIZATION
Edith I. Reed, comp. Oct. 1977 107 p refs Submitted for publication
(NASA-TM-78037; X-624-77-261) Avail: NTIS HC A06/MF A01 CSCL 04A

Stratospheric photochemistry was studied, with emphasis on the Ozone-NOx-ultraviolet flux interactions, but also including members of the chlorine, water vapor, and carbon-containing families. Secondary objectives include: (1) study of the balloon environment, (2) comparison of independent measurements of ozone and of NO, (3) development of new sensor systems, and (4) some measurements for exploratory purposes. Most, but not all, systems and instruments performed as planned, and it is believed that data are available to achieve most of the planned scientific and engineering objectives. The emphasis on photochemistry in the 35 to 40 km region is greater than anticipated, and observations are more complete for sunset than for sunrise. The planned instruments and a summary of the flight operations is discussed partly for the mutual information of those participating and partly for the wider scientific community. Author

N78-11545*# National Aeronautics and Space Administration, Washington, D. C.
NATIONAL GEODETIC SATELLITE PROGRAM, PART 1
Final Report
S. W. Henriksen, ed. (Am. Geophys. Union) 1977 523 p refs 2 Vol.
(NASA-SP-365-Pt-1) Avail: NTIS MF A01; SOD HC CSCL 04A

The work performed by individual contributors to the National Geodetic Satellite Program is presented. The purpose of the organization, the instruments used in obtaining the data, a description of the data itself, the theory used in processing the data, and evaluation of the results are detailed for the participating organizations. For individual titles, see N78-11546 through N78-11551.

N78-11546*# American Geophysical Union, Washington, D.C.
INTRODUCTION: NATIONAL GEODETIC SATELLITE PROGRAM, PART 1
S. W. Henriksen *In* NASA, Washington Natl. Geodetic Satellite Program, Pt. 1 1977 p 3-85 refs (For availability see N78-11545 02-46)
Avail: NTIS MF A01; SOD HC CSCL 04A

Background for the National Geodetic Satellite Program (NGSP) is presented. An historical summary of the program and its technical structure is given. The technical structure of the program is described in enough detail that the reader can relate the work of the individual contributors to each other and to the NGSP. G.D.H.

N78-11547*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
NATIONAL GEODETIC SATELLITE PROGRAM, PART 1
C. A. Dunnell, P. Ferriter, G. Gebel, H. S. Hopfield, M. M. Schaefer, and S. M. Yionoulis *In* NASA, Washington Natl. Geodetic Satellite Program, Pt. 1 1977 p 89-138 (For availability see N78-11545 02-46)
Avail: NTIS MF A01; SOD HC CSCL 04A

The Applied Physics Laboratory (APL) space research program was directed toward modeling the gravitational field of the earth from an analysis of the Doppler shifts on the transmitted frequencies of the satellites as obtained by the tracking stations. Emphasis is on the satellites involved and the methods used in accomplishing this aim. G.D.H.

N78-11548*# Department of Defense, Washington, D. C.
NATIONAL GEODETIC SATELLITE PROGRAM, PART 1
R. Anderle, D. C. Brown, E. Cyran, D. H. Eckhardt, G. Dudley, W. D. Googe, G. Hadgigeorge, D. Huber, R. L. Iliff, N. Mason et al *In* NASA, Washington Natl. Geodetic Satellite Program, Pt. 1 1977 p 139-245 (For availability see N78-11545 02-46)

Avail: NTIS MF A01; SOD HC CSCL 04A

Equipment and techniques were evaluated operationally, by the Department of Defense, during the National Geodetic Satellite Program (NGSP). The theory, instrumentation, and data reduction methods used are described. Results obtained during the NGSP are given. G.D.H.

N78-11549*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NATIONAL GEODETIC SATELLITE PROGRAM, PART 1
P. B. Esposito, N. A. Mottinger, T. D. Moyer, and D. W. Trask *In its* Natl. Geodetic Satellite Program, Pt. 1 1977 p 249-292 (For availability see N78-11545 02-46)
Avail: NTIS MF A01; SOD HC CSCL 04A

Determinations of tracking station locations and the gravitational constant of the earth, based on Doppler-tracking data from lunar and planetary spacecraft are presented. Two-way Doppler data obtained by the Deep Space Network of the Jet Propulsion Laboratory (JPL) were used. The Deep Space Station instrumentation that JPL employed is described. How the stations were located is detailed, and the data used are discussed. Results are given together with an analysis of the errors. G.D.H.

N78-11550*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NATIONAL GEODETIC SATELLITE PROGRAM, PART 1
J. H. Berbert, J. Brownd, T. Felsentreger, D. Harris, T. S. Johnson, M. A. Khan, F. Lerch, J. Marsh, J. Murphy, B. Putney et al *In its* Natl. Geodetic Satellite Program, Pt. 1 refs (For availability see N78-11545 02-46)
Avail: NTIS MF A01; SOD HC CSCL 04A

The contribution of the Goddard Space Flight Center to the National Geodetic Satellite Program is reported. All of the major types of tracking systems, including those employing optical, electronic, range-and-range-rate, and laser technologies, which were developed and operated by Goddard, are described. The MINITRACK data were used to derive geodetic results. The methods used for the analysis of these data are presented. G.D.H.

N78-11551*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
NATIONAL GEODETIC SATELLITE PROGRAM, PART 1
J. Belgin, A. Borrego, R. L. Brooks, D. J. Dempsey, N. M. Fubara, K. Guard, M. Hillhouse, C. D. Leitao, C. F. Martin, G. Mourad et al *In its* Natl. Geodetic Satellite Program, Pt. 1 1977 p 487-524 (For availability see N78-11545 02-46)
Avail: NTIS MF A01; SOD HC CSCL 04A

The major accomplishments of the GEOS-B, C-band systems project is assessed. The project objectives are given, namely: (1) primary objectives that must be met for project success; (2) secondary objectives that were sufficiently important to warrant serious consideration; and (3) other objectives that were important to the project and for which additional effort would be desirable. The primary objectives are presented and discussed in detail. G.D.H.

N78-11552*# National Aeronautics and Space Administration, Washington, D. C.
NATIONAL GEODETIC SATELLITE PROGRAM, PART 2
Final Report
1977 509 p refs 2 Vol.
(NASA-SP-365-Pt-2) Avail: NTIS MF A01; SOD HC CSCL 04A

The work performed by individual contributors to the National Geodetic Satellite Program is presented. The purpose of the specific organization, the instruments used in obtaining the data, a description of the data itself, the theory used in processing the data, and evaluation of the results are detailed for each participating organization. An overall evaluation of the entire program is given. For individual titles, see N78-11553 through N78-11557.

N78-11553*# National Geographic Society, Washington, D. C.
NATIONAL GEODETIC SATELLITE PROGRAM, PART 2
H. Schmid *In* NASA, Washington Natl. Geodetic Satellite Program, Pt. 2 1977 p 527-643 (For availability see N78-11552 02-46)
Avail: NTIS MF A01; SOD HC

Satellite geodesy and the creation of worldwide geodetic reference systems is discussed. The geometric description of the surface and the analytical description of the gravity field of the earth by means of worldwide reference systems, with the aid of satellite geodesy, are presented. A triangulation method based on photogrammetric principles is described in detail. Results are derived in the form of three dimensional models. These mathematical models represent the frame of reference into which one can fit the existing geodetic results from the various local datums, as well as future measurements. G.D.H.

N78-11554*# Ohio State Univ., Columbus. Dept. of Geodetic Science.
NATIONAL GEODETIC SATELLITE PROGRAM, PART 2
I. I. Mueller *In* NASA, Washington Natl. Geodetic Satellite Program, Pt. 2 1977 p 647-791 (For availability see N78-11552 02-46)
Avail: NTIS MF A01; SOD HC CSCL 08F

Data analysis was carried out to obtain an improved global network combining all participating tracking stations in a single worldwide coordinate system. Mathematical formulations were derived, programmed, and tested. Observational data were used to determine the relative positions of tracking stations in an arbitrary Cartesian coordinate system. The position of this coordinate system was estimated with respect to an absolute system. A primary network was established in which station positions were known to an internal consistency of 10 meters or better for the following purposes: (1) to establish the relative relationships between the various geodetic datums in use around the world; and (2) to connect isolated tracking stations, islands, navigational beacons, and other points of interest. Results are presented. G.D.H.

N78-11555*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
NATIONAL GEODETIC SATELLITE PROGRAM, PART 2
D. A. Arnold, E. M. Gaposchkin, Y. Kozai, J. Latimer, C. G. Lehr, C. A. Lundquist, G. Mendes, M. R. Pearlman, J. M. Thorp, C. R. H. Tsiang et al *In* NASA, Washington Natl. Geodetic Satellite Program, Pt. 2 1977 p 795-939 (For availability see N78-11552 02-46)
Avail: NTIS MF A01; SOD HC

A sequence of advances in the determination of geodetic parameters presented by the Smithsonian Astrophysical Observatory are described. A Baker-Nunn photographic system was used in addition to a ruby-laser ranging system to obtain data for refinement of geodetic parameters. A summary of the data employed to: (1) derive coordinates for the locations of various tracking stations; and (2) determine the gravitational potential of the earth, is presented. G.D.H.

N78-11556*# California Univ., Los Angeles.
NATIONAL GEODETIC SATELLITE PROGRAM, PART 2
W. M. Kaula *In* NASA, Washington Natl. Geodetic Satellite Program, Pt. 2 1977 p 943-948 (For availability see N78-11552 02-46)
(Contract NSR-05-007-060)
Avail: NTIS MF A01; SOD HC CSCL 08F

Satellite orbit analyses are presented which were undertaken for: (1) reasons of insight and economy; (2) obtaining geophysically interesting tesseral harmonics; (3) comparing effects of tracking station location error drag, radiation pressure, and luni-solar attraction to tesseral harmonic effects; and (4) combination of satellite and terrestrial data. The analyses were divided into the following phases: (1) MINITRACK interferometry; early Baker-Nunn camera directions; (2) late Baker-Nunn camera directions; and (3) combined Baker-Nunn camera and TRANET Doppler data. G.D.H.

N78-11557*# American Geophysical Union, Washington, D.C.
NATIONAL GEODETIC SATELLITE PROGRAM, PART 2
S. W. Henriksen *In* NASA, Washington Natl. Geodetic Satellite Program, Pt. 2 1977 p 951-984 (For availability see N78-11552 02-46)
Avail: NTIS MF A01; SOD HC

The National Geodetic Satellite Program (NGSP) was evaluated to see if the program objectives were actually met.

An inspection of the results shows that the general objectives were met. It is concluded that the specific results of the NGSP were too generally stated to allow one to tell whether they were met or were unobtainable. Analysis of methods and results shows that the standard deviations assigned to the results are indications of precision, not accuracy, and cannot be used to rank the various sets of coordinates in order of accuracy. G.D.H.

N78-11558*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
ENERGIZATION OF POLAR-CUSP ELECTRONS AT THE NOON MERIDIAN Progress Report
J. D. Craven and L. A. Frank Jul. 1977 29 p refs
(Contract NAS5-11265; Grant NGL-16-001-002; Contract N00014-76-C-0016)
(NASA-CR-155235; AD-A042687; U-of-Iowa-77-19) Avail: NTIS HC A03/MF A01 CSCL 04/1

Observations gained with an electrostatic analyzer on board the low-altitude satellite Ariel 4 demonstrate that the directional, differential spectra of polar-cusp electron intensities are regulated by the sign of the elevation angle of the interplanetary magnetic field, theta(IMF). The altitude of the nearly circular, polar orbit was about 550 km. In the energy range 200 less than E less than 700 eV, spectra of polar-cusp electron intensities were not observed to respond to changes in the sign of theta(IMF). At greater energies, spectra were found to be significantly harder when theta(IMF) greater than 0 deg with enhancements of a factor of about 10 typical for 2 keV electron intensities. Furthermore, these enhanced intensities appear to be localized within about a 1-hour sector of magnetic local time centered on the noon meridian. Enhanced intensities were detected during each sampling of electron intensities at local times MLT = 11.5 - 12.6 hours when theta(IMF) greater than 0 deg, but were observed only occasionally at lesser and greater local times. The physical processes responsible for the observed enhancements in electron intensities are of an unknown nature. Trapped magnetospheric electrons of sufficient intensities, which are generally present just equatorward of the polar cusp, are ruled out as a possible source. GRA

N78-11559# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
DYNAMIC OIL SHALE FRACTURE EXPERIMENTS Final Report, 1 Apr. 1975 - 31 Mar. 1977
Michael P. Felix 15 Mar. 1977 35 p Presented at Los Alamos Oil Shale Fracture Conf., Los Alamos Scientific Lab., N. Mex., Aug. 1976
(Grant NSF ENG-75-10313)
(PB-269258/0; A/A-77/2) Avail: NTIS HC A03/MF A01 CSCL 08I

The dynamic tensile stress amplitudes necessary to cause complete spall in unconfined oil shale samples were experimentally determined in the laboratory for pulse durations typically encountered in the field (60-100 microseconds). Tensile stresses were generated by free surface reflection of compressive pulses, and the stress-time history at the free surface was obtained by numerically differentiating the displacement-time history monitored by a fiber optic proximity sensor. A computer code was written to display the stress profile, obtained experimentally, over the length of the specimen as time increased. By using many specimens, the fracture thresholds for these pulse durations were determined. GRA

N78-11560# Lincoln Lab., Mass. Inst. of Tech., Lexington.
NIGHT-SKY ASTRONOMICAL CONDITIONS AT THE GEODSS ETS FROM AUGUST 1975 TO MARCH 1977
Eugene W. Rork 21 Jun. 1977 43 p refs
(Contract F19628-76-C-0002)
(AD-A043631; ETS-14; ESD-TR-77-150) Avail: NTIS HC A03/MF A01 CSCL 03/1

Night-sky brightness, atmospheric extinction, image stability, and cloud cover have been monitored at the GEODSS Experimental Test System, located on the White Sands Missile Range, N. M., since August 1975. These quantities were monitored because the ability of an electro-optical sensor--particularly one which is photon-noise limited--to detect a satellite is a function of them. The results of the measurements of these quantities up through March 1977 are tabulated in this note, accompanied by an explanation of their meaning, and the measurement techniques used. GRA

N78-11561# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
IONOSPHERIC IRREGULARITIES: OPTICAL SUPPORT OF HAES SCINTILLATION EXPERIMENTS Final Report, 15 Dec. 1975 - 31 Jan. 1977
Robert D. Sears 31 Jan. 1977 89 p refs
(Contract DNA001-76-C-0182)
(AD-A043666; DNA-4240F) Avail: NTIS HC A05/MF A01 CSCL 04/1

Photometric measurements of auroral spectral emission features and of the horizontal phase velocity of auroral motions were conducted at Chatanika, Alaska during several observing periods in 1976. These experiments provided ground-based optical support for the DNA HAES (High Altitude Effects Simulation) rocket experiments launched from Poker Flat. Multispectral data on the auroral emission intensities at 4278A and 6300A and the intensity ratio was analyzed in terms of the mean energy parameter for an assumed Maxwellian flux of precipitating electrons. Comparison between photometric determination of the mean energy parameter and that derived from incoherent scatter radar data provided a useful cross calibration of the two measurement techniques. This agreement also tends to confirm the theoretical predictions for the intensity ratio R sub 64 1(6300)/1(4278) as a function of the mean energy parameter. Additional analytical work was conducted to improve the three beam analysis code which allows inference of auroral E-fields and associated quantities from the auroral motion and intensity data. Results of the improved code are presented for the WIDEBAND rocket support experiment. GRA

N78-11562# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
FURTHER EVALUATION OF ICECAP AURORAL 4.3 MICROMETERS ZENITH RADIANCE. HAES REPORT NUMBER 57 Final Report, 1 Aug. 1975 - 31 Oct. 1976
J. B. Kumer Oct. 1976 80 p refs
(Contract DNA001-76-C-0015)
(AD-A043420; LMSC-D554539; DNA-4260F; DNA-HAES-57)
Avail: NTIS HC A05/MF A01 CSCL 04/1

The author has successfully developed the numerical facility to solve the exact time dependent plane parallel radiation transport equations which describe 4.3 micrometer emission in the upper atmosphere. He found that accurate modeling for high altitude CO2 4.3 micrometer emissions requires that the effects of the weak CO2 4.3 micrometer bands be included in the calculation. He used this improved facility for assessment of 4.3 micrometer zenith radiance data obtained 24 March 1973 and found that somewhat better agreement with these data were obtained in the altitude region z less than 90 km than he had previously reported. It was the inclusion of the weak CO2 nu sub 3 bands which resulted in obtaining a better fit to these data in the region z less than 90 km. A 4.3 micrometer zenith radiance component which has its maximum at z approximately 80 km appears in the 4.3 micrometer zenith radiance data obtained on 11 April 1974 and 27 March 1973 under quiet aurora conditions and also perhaps in the 25 February 1974 upleg data obtained in the edge of a discrete arc. GRA

N78-11563# World Meteorological Organization, Geneva (Switzerland).
THIRTEENTH SESSION OF THE JOINT ORGANIZING COMMITTEE Global Atmospheric Research Program
1977 138 p Conf. held at Stockholm, 14-20 Apr. 1977 Prepared jointly with ICSU, Rome
Avail: NTIS HC A07/MF A01; WMO, Geneva

The following topics were discussed: the global experiment, GARP climate dynamics subprogram, other GARP subprograms and related projects, and the organization of future work. Annexes cover various responses and reports including that of the working group on numerical experimentation. ESA

N78-11148*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. TDA Engineering Office.
ELECTRON DENSITY IN THE EXTENDED CORONA: TWO VIEWS

A. L. Berman *In its* The Deep Space Network 15 Oct. 1977 p 135-145 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 04A

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N78-11564 California Univ., Los Angeles.
A NUMERICAL INVESTIGATION OF THE EFFICIENCY WITH WHICH SIMPLE COLUMNAR ICE CRYSTALS COLLIDE WITH SUPERCOOLED WATER DROPS Ph.D. Thesis
Richard James Schlamp 1977 274 p
Avail: Univ. Microfilms Order No. 77-17239

A summary of numerical investigations designed to examine a portion of the cloud glaciation microphysical process is given. A fuller elucidation of the riming mechanism through an examination of the interaction of simple columnar ice crystals with supercooled water drops is presented. From these results, columnar ice crystal collision efficiencies for supercooled drops are derived and presented. Trajectories of supercooled water drops past columnar ice crystals of finite length were then obtained by a newly developed semi-empirical version of the superposition method for an environment of -8 C and 800 mb. From these trajectories, collision efficiencies were then derived and tabulated. The results predicted that riming on a columnar ice crystal will not commence until the crystal has a diameter larger than about 50 microns. Results from both sets of trajectory calculations indicate that there exist regions of zero collision efficiency at both the small and large drop ends of the collision efficiency curves presented. Analysis of individual trajectories indicated that such a result was due to the two dimensionality of the flow fields obtained for flow about the columnar ice crystal.
Dissert. Abstr.

N78-11565 Purdue Univ., Lafayette, Ind.
AVAILABLE POTENTIAL ENERGY AND KINETIC ENERGY PROCESSES DURING THE LIFE CYCLE OF AN EXTRATROPICAL CYCLONE Ph.D. Thesis
Govind Ballabh Pant 1976 112 p
Avail: Univ. Microfilms Order No. 77-15450

Available potential energy (APE) and kinetic energy (KE) budgets for a limited region containing, and moving with, an extratropical cyclone during various stages of its life cycle were computed using standard rawinsonde data. Only the baroclinic component of APE based on the specification of a reference state for the limited moving volume was considered. Parameterization schemes were used to estimate diabatic heating fields due to convective and stable latent heat release and long wave radiation since these were the major contributors to available potential energy generation. The heating fields were in good agreement with observed synoptic features and computed kinematic parameters.
Dissert. Abstr.

N78-11566 Deutscher Wetterdienst, Offenbach am Main (West Germany).
ANNALS OF METEOROLOGY NO. 12
1977 245 p refs Partly in GERMAN; partly in ENGLISH Proc. of the Meeting of Meteorologists, Garmisch-Partenkirchen, West Ger., 13-16 Apr. 1977
(ISBN-3-88148-150-8) Avail: Issuing Activity

Papers are presented in the field of meteorology, results of the GATE experiment are reported. Climate and climate models are discussed. Developments in hydrometeorology are outlined. Environmental aspects of the urban and rural climate are described. For individual titles, see N78-11567 through N78-11636.

N78-11567 Kiel Univ. (West Germany). Inst. fuer Meereskunde.
OCEANOGRAPHIC RESULTS OF GATE [OZEANOGRAPHISCHE ERGEBNISSE VON GATE]
G. Siedler *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 3-6 In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

The oceanographic measurement program of GATE is reviewed and results of two experiments are discussed: the C-Scale experiment concerning the development of the oceanic surface layer within the range of the intertropical convergence zone, and the equatorial experiment dealing with the properties of the equatorial undercurrent.
ESA

N78-11568 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.
STATUS OF THE GATE EXPERIMENT [DER STAND DES GATE-EXPERIMENTS]
Hans Hinzpeter *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 7-10 In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

Results of the mission of the meteorological ship, Meteor, are discussed. A subscale process concerning the cloud cluster of tropical oceans was investigated. These are cloud systems with cirrus shields of about 100 km diamter and a lifetime of from a half to a few days. The dissolving mechanism of this convective process was examined; in particular, which impulse and which enthalpy are transported to greater altitudes.
ESA

N78-11569 Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
VERTICAL MASS FLUX IN TROPICAL CLOUD AREAS [VERTIKALE MASSENFLUESSE IN TROPISCHEN WOLKENREALEN]
Eberhard Ruprecht *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 14-18 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

A method is discussed for determination of the spectral distribution of vertical mass flux inside tropical cloud areas from direct observation. The distribution of the various clouds in such a system can be best described by the summit altitude or the mixing factor. The statistical parameters of cloud areas are derived from radar observations during the third phase of GATE and the related Rawinsonde flights. The equation system is closed by precipitation data. The vertical mass flux of the single cloud groups (spectral distribution) within the cloud area is calculated using these data. Results are discussed for several synoptic situations.
ESA

N78-11570 Deutscher Wetterdienst, Offenbach am Main (West Germany).
EFFECT OF PRECIPITATION ON THE MEASUREMENTS OF THE TURBULENT WIND FIELD ABOVE THE SEA WITH CUP-TYPE ANEMOMETERS [NIEDERSCHLAGSEINFLUSS AUF MESSUNGEN DES TURBULENTEN WINDFELDES UEBER DER SEE MIT SCHALENKREUZANEMOMETERN]
Frank-Ulrich Dentler *In its* Annals of Meteorol. No. 12 1977 p 19-22 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

The quotient of wind velocity and circumferential velocity of a cup-type anemometer results as a solution of the system's equation of motion in the stationary case. The introduction of precipitation-produced rotational moments in this equation leads to an increase of this quotient. These deviations are in the order of magnitude of 2 to 3%, under worst conditions. In view of its dependence upon wind velocity this inaccuracy leads to erroneous determination of the vertical impulse flux, using the gradient law, as well as the friction coefficients. The order of magnitude of this error is in the range 1 to 2%.
ESA

N78-11571 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.
TURBULENT VERTICAL FLUXES NEAR WATER FOR DISTURBED AND UNDISTURBED CONDITIONS DURING GATE [WASSERNAHE TURBULENTE VERTIKALFLUESSE BEI GESTOERTEN UND UNGESTOERTEN BEDINGUNGEN WAEHREND GATE]
J. Wucknitz, D. Hasselmann, and M. Koenig *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 23-25 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

The turbulent vertical fluxes of latent and sensible heat showed characteristic increases for convection disturbance during GATE. The latent heat flux increases about 10% compared to undisturbed periods, while the sensible heat flux increases by about factor 4. Measurements of the vertical gradients of wind velocity, temperature, and water vapor confirm stability functions according to the Keyps formula and to Dyer. Direct determination of fluxes using buoys is made possible by using simultaneous measurement of the 6 buoy motion components. ESA

N78-11572 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

MEASUREMENTS OF THE INFRARED RADIANT FLUX DENSITY WITH RADIOSONDES DURING GATE [MESSUNGEN DER INFRAROTEN STRAHLUNGSFLUSSDICHTE MIT RADIOSONDEN WAEHREND GATE]

Hans P. Fimpel *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 26-29 refs In GERMAN; ENGLISH summary (For availability see N78-11566 02-47)

Avail: Issuing Activity

Flights were performed during GATE 37 with radiometersondes to measure the infrared radiant flux divergence. The sensor is described and some results are presented which show that clouds have a strong influence on the radiative flux divergences and the heating rates calculated from these. Due to the high variability of the clouds during the flights only three mean profiles of the heating rates could be calculated, for all flights and for those with clear and those with overcast sky. Author (ESA)

N78-11573 Ludwig-Maximilians-Universitat, Munich (West Germany). Inst. fuer Meteorologie.

DETERMINATION OF ATMOSPHERIC TURBIDITY USING GEOSTATIONARY SATELLITES DURING GATE [BESTIMMUNG DER ATMOSPHAERISCHEN TRUEBUNG MITTELS GEOSTATIONAEREM SATELLITEN WAEHREND GATE]

Peter Koepke *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 30-33 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

A method is proposed for determination of the atmospheric turbidity from radiant flux density measurement by geostationary satellites above water without cloud cover. The turbidity in the GATE area during average conditions can be determined with an accuracy of about 20%. Lines of equal turbidity from radiant flux density measurements of the SMS satellite are given as an example. ESA

N78-11574 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.

HYDRODYNAMIC ROUGHNESS OF THE SEA SURFACE AT LOW WIND VELOCITIES [DIE HYDRODYNAMISCHE RAUHIGKEIT DER MEERESOBERFLAECHE BEI NIEDRIGEN WINDGESCHWINDIGKEITEN]

Klaus Dittmer *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 34-36 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

The hydrodynamic sea surface roughness was investigated during GATE using the aerodynamic profile or gradient method, based on wind, temperature, and moisture profile measurements by buoys. The friction coefficient, related to the neutral layer, was found to be independent of the wind velocity for low velocities. The sea surface is hydrodynamically rough. The validity of the Charnock formula is not confirmed. ESA

N78-11575 Kernforschungsanlage, Juelich (West Germany). Inst. fuer Atmosphaerische Chemie.

CONCENTRATION OF TRACE ELEMENTS IN RAIN WATER AT THE METEOR STATION DURING GATE

Gode Gravenhorst and Juergen Mueller (Umweltbundesamt) *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 37-38 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

Two types of trace elements were investigated: (1) ammonium ions using the indophenol blue method and sulfate ions using the isotope dilution analysis, and (2) the metal elements iron, aluminum, manganese, and cadmium with flameless atomic absorption spectroscopy. Results are given and compared to measurements in the North Atlantic, the Alps, southern Germany, and the Frankfurt area. ESA

N78-11576 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

INVESTIGATIONS OF THE ATMOSPHERIC RADIATION BUDGET IN THE SPECTRAL SHORT WAVE RANGE DURING GATE [UNTERSUCHUNGEN ZUR STRAHLUNGSBILANZ DER ATMOSPHAERE IM KURZWELLIGEN SPEKTRALGEBIET WAEHREND GATE]

H. Queck *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 39-40 refs In GERMAN; ENGLISH summary (For availability see N78-11566 02-47)

Avail: Issuing Activity

The radiosonde for measuring the radiant fluxes is described in brief, and the results of the ascents done during the three parts of the GATE expedition are discussed. The aim of the measurements was an evaluation of the vertical variation of the budget components (reflection, transmission, and absorption) and the heating rates as a function of the weather conditions. The ascents are divided into classes of cloudiness. The resulting variations of the budget are reported. Author (ESA)

N78-11577 Max-Planck-Institut fuer Meteorologie, Hamburg (West Germany).

CLIMATE AND CLIMATE PREDICTION [KLIMA UND KLIMAVORHERSAGE]

K. Hasselmann and K. Herterich *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 42-46 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

Climate prediction based on the internal development of the climate system for fixed boundary conditions is discussed. Most important components of a related climatic model are: prognostic equations of the inertial components of the climate systems, i.e., the ocean, cryosphere, land vegetation, and parameterized representations of the atmospheric circulation as a function of the prognostic climate variables. The parameterization of the atmospheric circulation should account not only for average fluxes but also fluctuating terms. The latter can contribute decisively to the stochastic excitation of the observed climate variability. ESA

N78-11578 Max-Planck-Institut fuer Meteorologie, Hamburg (West Germany).

STOCHASTIC CLIMATE MODELS. APPLICATION TO ZONAL AVERAGE ENERGY BUDGET MODELS [STOCHASTISCHE KLIMAMODELLE. ANWENDUNG AUF ZONAL GEMITTELTE ENERGIEBILANZMODELLE]

Peter Lemke *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 47-49 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

A stochastic Budyko model is considered in which, contrary to the customary statistical dynamic models, the weather fluctuations are not averaged out but are used as internal stochastic excitation, producing climate variations. As a result, the climate variables such as the surface temperature can no longer be determined deterministically but should be considered as stochastic variables, described, e.g., by their variance spectrum. The calculation spectra of the annual and zonal average surface temperature agree with observations as regards their form and their order of magnitude. ESA

N78-11579 Max-Planck-Institut fuer Meteorologie, Hamburg (West Germany).

SOLUTION OF EQUATIONS OF MOTION BY PROJECTION ON PARAMETER EQUATIONS, DESCRIBED BY THE OCEAN SURFACE LAYER [LOESUNG VON BEWEGUNGSGLEICHUNGEN DURCH PROJEKTION AUF PARAMETERGLEICHUNGEN, DARGESTELLT AN DER OZEANISCHEN DECKSCHICHT]

G. Leipold and K. Hasselmann *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 50-51 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

The three-dimensional model of the wind-mixed ocean surface layer under consideration allows investigation of the long term and seasonal variability of the surface temperature field in the equatorial zone as a function of the atmospheric excitation function. Depth and density of the layer are considered prognostically, and the flow diagnostically. The actual fields are approximated by assumed fields with variable time dependent parameters. The equations of motion are projected on equations for these parameters. ESA

N78-11580 Max-Planck-Institut fuer Meteorologie, Hamburg (West Germany).
SEA SURFACE TEMPERATURE ANOMALIES IN THE NORTH PACIFIC OCEAN
Richard W. Reynolds *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 52-53 refs (For availability see N78-11566 02-47)
Avail: Issuing Activity

Twenty eight years of sea surface temperature anomalies in the north Pacific Ocean were compared with a first-order autoregression process which is forced by atmospheric white noise. Results show that this process can explain the variance spectrum of these anomalies for much of the mid-latitude regions. Author (ESA)

N78-11581 Ludwig-Maximilians-Universitat, Munich (West Germany). Inst. fuer Meteorologie.
LINEAR THEORY OF THE EFFECT OF SEA SURFACE TEMPERATURE ANOMALIES ON THE ATMOSPHERIC CIRCULATION [ZUR LINEAREN THEORIE DES EINFLUSSES VON ANOMALIEN DER OBERFLAECHENTEMPERATUR DES MEERES AUF DIE ATMOSPHAERISCHE ZIRKULATION]
Josef Egger *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 54-56 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

The linear theory of standing planetary waves is used to describe characteristics of ground pressure anomalies observed as a result of anomalies in sea surface temperature. This is exemplified for the north Atlantic area and the tropical Pacific. ESA

N78-11582 Goettingen Univ. (West Germany). Lehrstuhl fuer Bioklimatologie.
PROPERTIES OF INVERSIONS IN SEVERAL CLIMATE REGIONS [EIGENSCHAFTEN VON INVERSIONEN IN VERSCHIEDENEN KLIMAGEBIETEN]
H. Kraus and E. Schaller *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 57-60 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

A thermodynamic three-layer model was used to simulate inversions with a view to determining their role in climatological considerations of the atmospheric boundary layer. The vertical distribution of state parameters and energy flux densities of the inversion and the overall boundary layer were investigated for typical input parameters of certain climate areas, such as surface temperature or advection. A comparison with measurements shows that simulation with this simple tool produces good results. ESA

N78-11583 Goettingen Univ. (West Germany). Lehrstuhl fuer Bioklimatologie.
RADIATION PHENOMENA IN MODELS WITH LARGE AREA INVERSIONS [STRAHLUNGSVORGAENGE IN MODELLEN WEITRAEUMIGER INVERSIONEN]
E. Schaller and H. Kraus *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 61-64 In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

A three-layer model with a well-mixed boundary layer and an inversion at the upper limit was used to investigate the effect of radiation on the equilibrium state and the time dependence of this inversion. Two parameters, the radiation budget difference between inversion upper and lower limit and the divergence of the radiation budget, were considered. Calculations were carried out for two parameter cases, characteristic for the trade wind region and the the polar sea region. High inversions with thin stratus clouds were found for the trade wind region, and a low lying inversion with a large cloud height on the divergence of the horizontal wind field and on the radiation parameter was found for a trade wind inversion, the development of which was traced for 11.5 days in April. ESA

N78-11584 Deutscher Wetterdienst, Hamburg (West Germany).
INFLUENCE OF CLOUD COVER ON THE SHORT AND LONG WAVE RADIATION FLUX AT GROUND LEVEL [DER EINFLUSS DER BEWOELKUNG AUF DIE KURZ- UND LANGWELLIGEN STRAHLUNGSFLUESSE AM BODEN]
Fritz Kasten *In its* Annals of Meteorol. No. 12 1977 p 65-68 In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

The effect of cloud cover on radiation at ground level was investigated for quantitative estimates of the energy budget at the earth's surface and their application to climate studies and solar energy utilization. The dependence of the radiative flux upon the cloud cover is parameterized. Evaluation results of several years of continuous measurement series of the hourly sums of short and long wave, downward and upward, radiation fluxes, and of simultaneous cloud observations, are reported. ESA

N78-11585 Max-Planck-Institut fuer Meteorologie, Hamburg (West Germany).
THE ALBEDO OF CLOUDS [DIE ALBEDO VON WOLKEN]
Hartmut Grassl *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 69-71 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

The variation of cloud albedo and the influence of the (contaminated) drop size distribution, the condensation nuclei, and the resulting drop size on the albedo were evaluated using a plane parallel model of radiation transmission with measured aerosol absorption. The spectral range considered was from 0.3 to 3.7 micron, including 99% of solar radiation density. The absorption and transmission, as well as divergences of the net radiant flux density within the cloud, were also determined so that these parameters can be estimated at the edges. ESA

N78-11586 Ludwig-Maximilians-Universitat, Munich (West Germany). Lehrstuhl fuer Bioklimatologie und Angewandte Meteorologie.
POTENTIAL ANTHROPOGENIC EFFECTS ON THE GLOBAL DISTRIBUTION OF THE SURFACE ALBEDO AND THE ROUGHNESS PARAMETER [POTENTIELLE ANTHROPOGENE EINFLUESSE AUF DIE GLOBALE VERTEILUNG DER OBERFLAECHENALBEDO UND DES RAUHINGKEITSPARAMETERS]
Manfred Kirchner and Helmut Mayer (Forstl. Forschungsanstalt) *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 72-75 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

The changed global distribution of the surface albedo and the roughness parameter is discussed for a surface cover accounting for three potential anthropogenic influences: growth of the ice zones, transformation of all forest surfaces into grasslands or grain surfaces, and transformation of all desert areas into grasslands or grain surfaces. ESA

N78-11587 Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
PARAMETER REPRESENTATION OF THE RADIATIVE PROPERTIES OF CLOUD COVER [ZUR PARAMETERDARSTELLUNG DER STRAHLUNGSEIGENSCHAFTEN VON BEWOELKUNG]
H.-J. Jung, M. Kerschgens, U. Pilz, E. Raschke, and J. Schmetz *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 76-79 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

Criteria for cloud cover are discussed which should allow quantitative processing for determining the radiative properties of cloud fields from observation material. These criteria should indicate phase state, geometry, height, content, and the drop size spectrum. Some possibilities are discussed using detailed calculations of the radiation transport in the spectral range of solar and terrestrial radiation. Measurements made onboard the

Meteor research ship in spring 1976 are also taken into account. ESA

N78-11588 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.

THE REAL TROPOSPHERIC TEMPERATURE TREND ON THE NORTHERN HEMISPHERE 1950-1976 [DER TATSAECHLICHE TROPOSPHAERISCHE TEMPERATURTREND AUF DER NORDHALBKUGEL 1950-1976]

Manfred Geb *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 80-83 refs In GERMAN; ENGLISH summary (For availability see N78-11566 02-47)

Avail: Issuing Activity

The real tropospheric temperature trend for the Northern Hemisphere was computed by comparing the 1000/300 mb thickness of the clino-period 1951 to 60 with the actual four year mean thickness 1973 to a 76. For this purpose a special procedure was applied: reducing all available 300 mb-radiosonde records considering the U.S. radiosonde as a reference sonde for temperature and geopotential height. A real temperature trend of 0.25 K was computed for polar and middle latitudes and about zero for the tropical zone, in good agreement with computed surface temperature trends. A trend due to the change or improvement of radiosonde equipment of 0.50 and 0.34 K for the tropospheric layer was also considered. Author (ESA)

N78-11589 Wisconsin Univ., Madison.

CIRCULATION FLUCTUATIONS AND CLIMATIC ANOMALIES AT LOWER LATITUDES [ZIRKULATIONSSCHWANKUNGEN UND KLIMAANOMALIEN IN NIEDEREN BREITEN]

Stefan Hastenrath *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 84-86 refs In GERMAN Sponsored by NSF (For availability see N78-11566 02-47)

Avail: Issuing Activity

A project is outlined which attempts to establish the large-scale circulation characteristics associated with extreme climatic conditions (precipitation intensity at lower latitudes) in the Caribbean and an extensive sub-Sahara zone in Africa. ESA

N78-11590 Bonn Univ. (West Germany). Inst. fuer Meteorologie.

A SPECTRAL EDDY DRIVEN CLIMATIC MODEL [EIN SPEKTRALES, EDDY-GETRIEBENES KLIMAMODELL]

Michael Hantel *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 87-90 refs In GERMAN Sponsored by Deut. Forschungsgemeinschaft (For availability see N78-11566 02-47)

Avail: Issuing Activity

A climate model is designed by time averaging of the atmospheric conservation equations. This model is driven by eddy fluxes as well as radiation and condensation. The mean fields are spectrally represented in all coordinates. A Liapunov function is assigned to the resulting algebraic equations system and interpreted as hyperplane. The zero point is found by iterative strategies and represents the climate point in the phase space. Generally, more climate points exist. Their physical meaning and their sensitivity for the driving functions are discussed for a one component system. ESA

N78-11591 Bonn Univ. (West Germany). Inst. fuer Meteorologie.

NUMERICAL SOLUTION METHOD FOR A TIME AND ZONE AVERAGED SPECTRAL GLOBAL CLIMATE MODEL [NUMERISCHES LOESUNGSVERFAHREN FUER EIN SPEKTRALES ZEITLICH UND ZONAL GEMITTELTES GLOBALES KLIMAMODELL]

Dietmar Dedenbach *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 91-94 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

A global, zone and time averaged, dry climate model is described by equations of motion, the continuity equation, the static ground equation, and the temperature equation. The three components of the mean wind, temperature, and geopotential are model variables. The model is driven by the diabatic heating and the eddy flux divergences. The variables are developed into a series of orthogonal eigenfunctions. A non linear algebraic equation system, which can be solved by an iterative method, is obtained by transformation in the spectral space. ESA

N78-11592 Flinders Univ., Bedford Park (Australia).

MERIDIONAL HEAT FLUXES IN THE SOUTHERN HEMISPHERE

J. A. T. Bye *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 95-96 refs (For availability see N78-11566 02-47)

Avail: Issuing Activity

The heat exchange flux between ocean and atmosphere can be determined using the heat transports of ocean currents. The annual mean northward heat trasport in the Southern Hemisphere results from a series of numerical experiments based on a global ocean model. Its magnitude is about a factor 3 larger than any meridional transport in the Northern Hemisphere. Negative temperature anomalies were found to exist in the coastal waters of south-east Australia and Patagonia. The zonal structure of the model, not shown in climatological atlases, is discussed. ESA

N78-11593 Wien Univ. (Austria). Inst. fuer Meteorologie und Geophysik.

SECULAR VARIATIONS OF AIR TEMPERATURE STATISTICAL PARAMETERS IN VIENNA [SAEKULARE SCHWANKUNGEN STATISTISCHER PARAMETER DER LUFTTEMPERATUR IN WIEN]

Konrad Cehak *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 97-100 In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

The secular variations of the statistical parameters mean value, scatter, slope, and excess coefficient, as well as the first four autocorrelation coefficients of the average daily temperature in January and July, are considered for Vienna over the period 1872 to 1970. The periods with higher and lesser variation in temperature within the individual months are recognized, and the consideration of the autocorrelation coefficients is related to frequency variations in synoptic systems. ESA

N78-11594 Schule fuer Wehrgeophysik, Fuerstenfeldbruck (West Germany).

A STATISTICAL MODEL FORMULATION FOR REPRODUCTION OF CLIMATOLOGICAL VARIATIONS [EIN STATISTISCHER MODELLANSATZ ZUR REPRODUKTION KLIMATOLOGISCHER SCHWANKUNGEN]

C. D. Schoenwiese *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 101-104 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

The possibility of using statistical methods to approximate periodic variations of climatological series was examined. The typical variation over a period greater than 1 year was used, based on the spectral variance analysis of European temperature series. The superposition of numerically filtered values in dominant rhythm periods led to a reproduction correlated with the air temperature of Uppsala, upon elimination of trends appearing over long periods. ESA

N78-11595 Bonn Univ. (West Germany). Inst. fuer Meteorologie.

TELECONNECTIONS OF PRECIPITATION VARIATIONS IN THE TROPICS [TELEKONNEKTIONEN DER NIEDERSCHLAGSSCHWANKUNGEN IN DEN TROPEN]

Heribert Fleer *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 105-108 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

Monthly, seasonal, and annual precipitation figures for 74 stations in the tropical zone between 15 deg S and 15 deg N were investigated in regard to spatial and timely distribution of precipitation anomalies, using statistical methods of autocorrelation-, phase-, and amplitude analysis. Numerical bandpass filtering shows that the maxima related to the spectral variance analysis are caused by the wavelike structure of the time series. Cross spectral and coherence analysis show that significant teleconnections of the monthly precipitation anomalies appear mainly in the wavelength range of over 5 years. ESA

N78-11596 Bonn Univ. (West Germany). Inst. fuer Meteorologie.

VERTICAL EDDY ROTATIONAL IMPULSE TRANSPORT IN THE NORTHERN HEMISPHERE [VERTIKALER EDDY-DREHIMPULSTRANSPORT IN DER NORDHEMISPHAERE]

Joerg M. Hacker *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 110-111 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

The vertical transport of rotational impulse by eddies was investigated. The atmosphere was divided into 300 equal mass boxes from 15 deg S to 90 deg N, to determine the transport in detail. Results show that the vertical eddy rotational impulse transport is of the same order of magnitude as the net vertical transport of the earth rotational impulse by the average meridional mass circulation, and a basic balance seems to exist between these transports. Other results include seasonal effects. ESA

N78-11597 Bundesanstalt fuer Gewaesserkunde, Koblenz (West Germany).

STATUS OF HYDROMETEOROLOGY [STAND DER HYDROMETEOROLOGIE]

H. J. Liebscher *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 112-118 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

A survey is presented of the most important research projects in the field of hydrometeorology during the International Hydrological Decade. The requirements and expectations of hydrology and water economy with respect to hydrometeorology are outlined, and it is shown in which areas research should be intensified. ESA

N78-11598 Muenster Univ. (West Germany). Inst. fuer Geographie.

CLIMATOLOGICAL WATER BALANCE OF GERMANY [KLIMATOLOGISCHE WASSERBILANZ VON DEUTSCHLAND]

I. Henning and D. Henning *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 119-123 In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

Charts are presented for Germany showing the annual water balance, the months with a deficit, and the balance sums of all months with a deficit and a surplus, respectively. ESA

N78-11599 Deutscher Wetterdienst, Offenbach am Main (West Germany).

METEOROLOGY IN THE OPERATIONAL HYDROLOGICAL PROGRAM [METEOROLOGIE IM OPERATIONELLEN HYDROLOGISCHEN PROGRAMM]

Hans Hinnerk Johannsen *In its* Annals of Meteorol. No. 12 1977 p 124-125 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

The Integrated Operational Hydrological System recommended by the WMO Commission for Hydrology represents a hydrological forecasting and consultancy service. The meteorological contribution consists of making available prepared climate data from meteorological parameters for water circulation and water balance, continuous communication of actual measurement results, and the forecasting of these parameters. ESA

N78-11600 Bayerisches Landesamt fuer Wasserwirtschaft (West Germany).

METEOROLOGICAL PROBLEMS IN DESIGNING A PRECIPITATION RUNOFF MODEL IN THE LECH-WERTACH AREA [METEOROLOGISCHE PROBLEME BEI DER AUFSTELLUNG EINES NIEDERSCHLAGSABFLUSS-MODELLES IM LECH-WERTACH-GEBIET]

Hans-Eckard Deisenhofen *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 126-128 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

A mathematical precipitation runoff model was designed for forecasting high water levels in the Lech and Wertach area. A long range transmission precipitation recording network is being built up for application of the model. Considerations regarding the selection of the gage type, density of the stations, and network configuration are described. The selected methods for calculation of the area's precipitation are explained. ESA

N78-11601 Deutscher Wetterdienst, Offenbach am Main (West Germany). Abt. Klimatologie.

SHORT TERM AREA PRECIPITATION FOR HYDROLOGICAL FORECASTING [KURZFRISTIGE GEBIETSNIEDERSCHLAEGE FUER HYDROLOGISCHE VORHERSAGEN]

Karl Hoffmann *In its* Annals of Meteorol. No. 12 1977 p 129-130 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

Three-hour area precipitations in small catchment areas of selected Rhine tributaries were used as input data for calibrating precipitation-runoff models. The rain gage network of the German meteorological service has meshes too wide for calculation of precipitation in areas. Therefore the daily precipitation figures of some hundred weather stations in these areas need to be transformed into three-hour precipitation figures using recordings of 24 stations. A network of 13 remote rain gages is under construction in order to complement the synoptic and automatic weather stations. ESA

N78-11602 Technische Universitaet, Hanover (West Germany). Inst. fuer Meteorologie und Klimatologie.

WATER BUDGET COMPONENTS OF TWO INLAND LAKES IN A DRY ENVIRONMENT [WASSERHAUSHALTSKOMPONENTEN VON ZWEI INLANDSSEEN IN TROCKENER UMGEBUNG]

G. Tetzlaff, K. A. Eggers, and R. Roth *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 131-133 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

An equation system for the energy budget of the water surface was set up for inland lakes. The surface temperatures were calculated and compared with the measured temperature of lake Chad (Africa) and lake Eyre (Australia). ESA

N78-11603 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.

A SIMPLE MODEL FOR ESTIMATING THE ENERGY BALANCE OF A WATER RESERVOIR [EIN EINFACHES MODELL ZUR ABSCHAETZUNG DER ENERGIEBILANZ EINES WASSERRESERVOIRS]

K. Fraedrich and A. Behlau *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 134-137 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

A simple model which reacts to atmospheric radiation conditions and hydrological effects was formulated for the simulation of water reservoir energy fluxes. Both processes are parameterized by two characteristic temperatures and time scales, describing the drive mechanism and the energy resonance of the reservoir. A normal differential equation was obtained for water temperature, and the overall reservoir energy balance can be calculated. An application to a well mixed reservoir, especially accounting for evaporation processes, shows good agreement with observations for the Salton Sea. ESA

N78-11604 Freie Univ., Berlin (West Germany). Inst. fuer Geophysikalische Wissenschaften.

EFFECTS OF SEA WIND CIRCULATION ON CONVECTIVE PRECIPITATION ACTIVITY IN FLORIDA [EINFLUESSE DER SEEWINDZIRKULATION AUF DIE KONVEKTIVE NIEDERSCHLAGSTAETIGKEIT IN FLORIDA]

Christian Zick *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 138-141 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

The timely and spatial vatriations of mesoscale sea wind convergences and divergences during the course of a day resulting from the difference in heating of the Florida peninsula and the surrounding water were calculated using a narrow-mesh three-dimensional multilayer model after Pielke. Results show that the distribution of the convective summer precipitation is determined mainly by the sea wind convergence structure, which in turn is affected by the intensity and direction of the general

flow as well as by the coastal profile. A case study using ATS 3 cloud photographs confirms the numerical results. ESA

N78-11605 Bonn Univ. (West Germany). Inst. fuer Meteorologie.
CLIMATOLOGICAL RELATION BETWEEN PRECIPITATION GENESIS AND INTENSITY DISTRIBUTION [KLIMATOLOGISCHE BEZIEHUNG ZWISCHEN NIEDERSCHLAGSGENESE UND INTENSITAETSVERTEILUNG]
Christa Korff and Clausen Korff *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 142-144 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

A method is presented which allows estimation of extreme precipitation events for all time intervals, based on the hourly intensities and their conservation tendency, and the Monte Carlo method. The intensity can be reduced to vertical wind and moisture in the atmosphere, which can be adapted to changing climatic conditions. ESA

N78-11606 Bonn Univ. (West Germany). Inst. fuer Meteorologie.
STRUCTURE ANALYSES AND STATISTICS OF PRECIPITATION ON SHORT TERM BASIS WITH 5 YEAR DISTROMETER MEASUREMENTS [STRUKTURANALYSEN UND STATISTIK DES NIEDERSCHLAGES AUF KURZZEITBASIS MIT 5-JAEHRIGEN DISTROMETERMESSUNGEN]
R. K. Kreuels and L. J. Breuer *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 145-148 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

The possibilities of time dependent rain measurement and research are discussed based on a data set of 158,000 continuously measured drop spectra. Extracts from statistics of spectral distributions in the course of a year of several meteorological constellations, and statistics of the rain intensity and their extreme values, are described and compared with results produced by others. The deviation of precipitation and the problem of its definition is also dealt with. ESA

N78-11607 Bonn Univ. (West Germany). Inst. fuer Meteorologie.
COMPARISON OF EQUAL PRECIPITATION INTENSITY RAINDROP SPECTRA ABOVE THE ATLANTIC (GATE) AND WEST GERMANY (BONN) [VERGLEICH VON REGENTROPFENSPEKTREN GLEICHER NIEDERSCHLAGSINTENSITAET UEBER DEM TROPISCHEN ATLANTIK (GATE) UND WESTDEUTSCHLAND (BONN)]
L. J. Breuer and R. K. Kreuels *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 149-152 refs In GERMAN; ENGLISH summary (For availability see N78-11566 02-47)
Avail: Issuing Activity

During GATE 1975, 873 raindrop spectra were obtained on the one minute time basis. The rainfall rate was calculated and compared to an interval of same intensity in Bonn for each of these rainfall minutes. The results show that on the tropical Atlantic weak and medium rainfall rates have lower numbers and longer drop sizes but heavy storms have more and smaller drops than in Western Germany. Author (ESA)

N78-11608 Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
NUMERICAL SIMULATION OF GRAUPEL FORMATION [NUMERISCHE SIMULATION DER GRAUPELBILDUNG]
Klaus D. Beheng *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 153-156 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

Graupel formation was calculated using numerical solutions of stochastic equations for the coalescence process of platelike ice crystals and water drops. The calculated graupel sizes and the time for their formation fit into the picture of short-lived convection clouds and agree with observations. ESA

N78-11609 Deutscher Wetterdienst, Hohenpeissenberg (West Germany).
AUTOMATIC AREA PRECIPITATION MEASUREMENTS WITH A C-BAND RADAR [AUTOMATISCHE FLAECHENNIEDERSCHLAGSMESSUNGEN MIT EINEM C-BAND-RADAR]
W. Attmannspacher, R. Aniol, R. Hartmannsgruber, and J. Riedl *In its* Annals of Meteorol. No. 12 1977 p 157-159 refs In GERMAN; ENGLISH summary (For availability see N78-11566 02-47)
Avail: Issuing Activity

The radar equipment, the digitalizing system of the video signal, and the calculation of the measured data by using a connected electronic computer are described briefly. Examples of measurements were compared to a special rain gage network. These comparisons as well as some statistical treatments underline the quality of the radar measurement. It is shown that area precipitation means over a period of about 2 months are measured in a realistic way only by radar. Author (ESA)

N78-11610 Deutscher Wetterdienst, Offenbach am Main (West Germany). Abt. Klimatologie.
COMPARATIVE MEASUREMENT OF WIND-PROTECTED AND UNPROTECTED RAIN GAGES [VERGLEICHSMESSUNG MIT WINDGESCHUETZTEN UND UNGESCHUETZEN NIEDERSCHLAGSMESSGERAETEN]
Helmut Kumm *In its* Annals of Meteorol. No. 12 1977 p 160-161 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

The effect of wind protection for rain gages was determined by parallel measurement with unprotected gages at 200 stations for 5 years. In particular, the aim was to find out at which station wind protection is effective and how results of measurements between the two types of gages can be made compatible. ESA

N78-11611 Deutscher Wetterdienst, Offenbach am Main (West Germany).
PLANS FOR A GLOBAL CLIMATOLOGY OF SNOW ALTITUDES [WEGE ZU EINER WELTWEITEN KLIMATOLOGIE DER SCHNEEHOEHEN]
Friedrich Lauscher *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 162-165 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

Analysis of European, in particular east Alpine, snow data is discussed, as well as studies on the general relationships of the percentage contribution of solid precipitation to overall precipitation. An attempt was made at estimating the expected snow altitude at any point by using global types of precipitation altitude dependance and the known decrease in temperature with altitude. ESA

N78-11612 Bayerisches Landesamt fuer Wasserwirtschaft (West Germany).
WEATHER AND AVALANCHES [WETTER UND LAWINEN]
Christa Rudolf *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 166-169 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

The degree of avalanche hazards is determined more by weather and atmospheric conditions and less by terrain effects than is generally assumed. Research points out to what high extent the structure of the snow cover, especially the irreversible snow crystal transformations and the formation of avalanche-favoring sliding surfaces, depends on meteorological parameters. Precipitation, wind, radiation, air temperature, and moisture have a great influence on avalanche hazards. ESA

N78-11613 Kernforschungsanlage, Juelich (West Germany). Inst. fuer Atmosphaerische Chemie.
DEPOSITION OF NITROGEN COMPONENTS BY PRECIPITATION [DEPOSITION VON STICKSTOFFKOMPONENTEN DURCH NIEDERSCHLAG]
A. Boettger, D. H. Ehhalt, and G. Gravenhorst *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 170-171 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

The deposition rate of nitrogen components was determined from deposition measurements of NO3-N and NH4-N for

the Northern Hemisphere. Aerosol and precipitation deposition was considered. A latitude dependance was found for the deposition and concentration in rain. The deposition of NO3-N was determined as being 16 plus or minus 6 Tg/year, for NH4-N 17 plus or minus 6 Tg/year. These results are, partly, considerably lower than earlier estimations. ESA

N78-11614 Bonn Univ. (West Germany). Inst. fuer Meteorologie.

EQUILIBRIUM EVAPOTRANSPIRATION [ZUR GLEICHGEWICHTSVERDUNSTUNG]

Dieter Henning *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 172-173 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

Equilibrium evapotranspiration is understood as being a ground evapotranspiration realized when a certain equilibrium is reached between relevant ground level and bulk level parameters. The evapotranspiration calculated under these conditions using the heat budget is thus considered to be the actual evapotranspiration. A method, based on Albrecht, is described, which allows calculation of actual evapotranspiration for an equilibrium between temperature and moisture at ground and at 2 m. ESA

N78-11615 Kernforschungsanlage, Juelich (West Germany). Inst. fuer Atmosphaerische Chemie.

PRECIPITATION EFFECTS ON THE DISTRIBUTION OF THE TRACE CONTAMINANTS SO2, NH3, HNO3, AND HCl IN THE TROPOSPHERE AND THE STRATOSPHERE [DER EINFLUSS VON NIEDERSCHLAG AUF DIE VERTEILUNG DER SPURENSTOFFE SO2, NH3, HNC3 UND HCl IN DER TROPOSPHAERE UND STRATOSPHAERE]

T. Janssen, G. Gravenhorst, and D. H. Ehhalt *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 174-175 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

A yardstick for the absorption of trace contaminants in rain water is the ratio of the absorbed volume to the volume remaining in gas phase. This parameter was calculated for HCl, HNO3, NH3, SO2, CFM 11 and CFM 12 gases with realistic atmospheric values. ESA

N78-11616 Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.

NUMERICAL SIMULATION OF RAIN FORMATION [NUMERISCHE SIMULATION DER REGENBILDUNG]

Manfred Laube *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 176-177 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

The balance equation for the mass distribution function of cloud droplets was used as a basis for a numerical model of rain formation. Parameters included were: drop growth velocity, described by the drop growth equation; drop production, described by the diffusion and sedimentative coagulation equation; and drop breaking. ESA

N78-11617 Hamburg Univ. (West Germany). Lehrstuhl fuer Bioklimatologie.

NUMERICAL EXPERIMENTS IN ANTHROPOGENIC MODIFICATION OF THE CITY CLIMATE [STADT-UND LANDSCHAFTSKLIMA]

H. Kraus *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 179-181 In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

A three-dimensional grid point model for an area of 30 km-30 km-0.7 km is proposed for investigation of the spatial and timely development of contaminant concentrations as a function of the boundary layer above the town and its diurnal variation. The average potential temperature, the horizontal wind, the ground temperature, and the average pollutant concentration for arbitrary source distribution are forecast for 1 to 2 days based on initial fields. The subscale turbulent flux parameters are parameterized using an exchange concept with a K-law based on the probability theory. Some results are given. ESA

N78-11618 Mainz Univ. (West Germany). Inst. fuer Meteorologie.

THE INFLUENCE OF THE SURFACE ROUGHNESS AND THE THERMAL STRATIFICATION ON THE CONCENTRATION DISTRIBUTION OF CONTAMINANTS IN THE ATMOSPHERE [DER EINFLUSS DER BODENRAUHIGKEIT UND DER THERMISCHEN SCHICHTUNG AUF DIE KONZENTRATIONSVERTEILUNG VON SCHADSTOFFEN IN DER ATMOSPHAERE]

Gisela Tangermann *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 182-185 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

The propagation behavior of gaseous contaminants leeward of high continuous point sources were investigated using numerical model calculations. The concentration fields were calculated using an algorithm which does not produce pseudodiffusion. The structure of the contaminant concentration distribution is determined by the surface roughness of the propagation terrain and the thermal stratification of the atmosphere. ESA

N78-11619 Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.

MEASUREMENTS IN THE PLANETARY BOUNDARY LAYER ABOVE THE CITY AREA OF COLOGNE USING A SOUND PULSE GENERATOR (SODAR) [MESSUNGEN IN DER PLANETARISCHEN GRENZSCHICHT UEBER DEM STADTGEBIET VON KOELN MIT EINEM SCHALLIMPULSGEBER (SODAR)]

W. Bahmann, W. Behnke, E. Raschke, G. H. Spohr, U. Steiner, and G. Warmbier *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 186-189 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

The buildup and disappearance of near-ground inversions have been monitored continuously at Cologne since June 1976 using SODAR. The statistical evaluation of the received backscatter signals facilitates microprocessor-controlled digitalizing. Provisional results of recordings between July and October 1976 are reported and discussed. ESA

N78-11620 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.

EFFECTS OF WOODED AND BUILT-UP AREAS OF THE URBAN LANDSCAPE OF BERLIN ON THE PRECIPITATION BUDGET [DIE AUSWIRKUNGEN DER BEWALDETEN UND BEBAUTEN GEBIETE DER STADTLANDSCHAFT VON BERLIN AUF DEN NIEDERSCHLAGSHAUSHALT]

Paul Schlaak *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 190-192 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

The precipitation distribution over the urban landscape of Berlin is considered, and effects of woods and built-up areas are related to this distribution. ESA

N78-11621 Freiburg Univ. (West Germany). Inst. fuer Geographie.

SURFACE AND AIR TEMPERATURE AS A FUNCTION OF BUILDING STRUCTURE (EXAMPLE FREIBURG IM BREISGAU) [OBERFLAECHEN- UND LUFTTEMPERATUR IN ABHAENGINGKEIT VON DER BAUKOERPERSTRUKTUR (BEISPIEL FREIBURG I. BR.)]

Albrecht Gehrke, Wilfried Nuebler, and Wolfgang Weischet *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 193-196 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

Results of measurements of the air and surface temperature distribution, several a day and during the year, are presented for Freiburg im Breisgau. The relation between surface temperature and near-ground temperature was investigated by detailed measurements of four characteristic building structures, typical of modern suburbs. ESA

N78-11622 Karlsruhe Univ. (West Germany). Inst. fuer Meteorologie.

CONTRADICTORY ASPECTS OF CITY AND LANDSCAPE CLIMATE REPRESENTATIONS [KONKURRIERENDE

GESICHTSPUNKTE DER ZIELVORSTELLUNGEN FUER DAS STADT- UND LANDSCHAFTSKLIMA]
Karl Hoeschele *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 197-200 refs In GERMAN; ENGLISH summary (For availability see N78-11566 02-47)
Avail: Issuing Activity

Contradictory climatological aspects in regional and town planning, as well as in building design were considered. The problem studied was that of reversing temperature and humidity conditions in urban atmospheres, as a consequence of evaporating areas, and their influence on sensible and latent heat flow in human heat balance. Other problems are airflow and solar radiation/shade effects. Various aspects of some projects, roof gardens and dams, are discussed. Author (ESA)

N78-11623 Zentralanstalt fuer Meteorologie und Geodynamik, Vienna (Austria).
VERTICAL TEMPERATURE DISTRIBUTION ABOVE A LARGE CITY [EIN BEITRAG ZUR VERTIKALEN TEMPERATURVERTEILUNG UEBER EINER GROSSTADT]
Alois Machalek *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 201-204 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

The vertical temperature profile of a large city was studied by measurements from two towers in Vienna. A layer of cold air masses (cold island effect or crossover effect) was detected above the city center, showing a dependence upon season and wind, and documented by the vertical contaminant gas distribution (SO2). The occurrence of inversions in the vertical temperature gradient above the city center was also investigated. ESA

N78-11624 Parma Univ. (Italy). Lab. di Climatologia.
AIR CIRCULATION PROFILE IN AN URBAN AREA [PROFIL DER LUFTZIRKULATION IN EINEM STADTGEBIET]
Guglielmo Zanella *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 205-208 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

A statistical comparison was made between eight-year wind observation series at two stations in Parma, Italy. The study covers the following aspects: diurnal variation of the calms and the wind velocity for months, seasons, and year; distribution of the wind according to velocity class and critical wind velocity value, which determines whether the wind in the city center is stronger than at the city boundary; and average wind direction at both stations. ESA

N78-11625 Deutscher Wetterdienst, Offenbach am Main (West Germany).
A METHOD FOR BIOCLIMATOLOGICAL EVALUATION OF THE THERMAL ENVIRONMENT [EIN VERFAHREN ZUR BIOKLIMATOLOGISCHEN BEWERTUNG DES THERMISCHEN MILIEUS]
G. Jendritzky, W. Soenning, and H. J. Swantes *In its* Annals of Meteorol. No. 12 1977 p 209-210 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

Model calculations are discussed for the city of Frankfurt (Germany) based on the Fanger comfort equation which combines the six factors determining the human thermal environment: air temperature, humidity, wind velocity, radiation, clothing, and activity. ESA

N78-11626 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
WIND AND INVERSION SITUATION OF THE LOCAL BERLIN CLIMATE [DIE LOKALKLIMATISCHEN WIND- UND INVERSIONSVERHAELTNISSE VON BERLIN]
Horst Malberg *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 213-217 In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

First results of an extensive investigation into the wind situation of the local Berlin climate are presented, together with the physical inversion parameters. The ground wind was observed at three stations over a period of 20 years. Inversion include all situations with a lower level up to 1000 m and cover the period 1965 to 1974. ESA

N78-11627 Freie Univ., Berlin (West Germany). Inst. fuer Geophysikalische Wissenschaften.
REPRESENTATION OF THE TIME DEPENDENCE OF SO2 DISTRIBUTION ABOVE WEST BERLIN IN A QUICK MOTION PICTURE [DARSTELLUNG DES ZEITLICHEN ABLAUFS VON SO2-VERTEILUNGEN UEBER BERLIN-WEST IM ZEITRAFFERFILM]
Benno Carus *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 218-221 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

The spatial-timely contaminant distribution above a large city is determined by advection from the neighboring land, emission within the area, and by meteorological parameters. The complexity of the relations is represented in a motion picture for West Berlin, the contents of which is described. ESA

N78-11628 Mainz Univ. (West Germany). Inst. fuer Meteorologie.
COMPARATIVE STUDY ON THE EFFECT OF THE AEROSOL ON THE ENERGY BUDGET OF THE RURAL AND URBAN ATMOSPHERE [VERGLEICHENDE STUDIE ZUM EINFLUSS DES AEROSOLS AUF DEN ENERGIEHAUSHALT DER RURALEN UND URBANEN ATMOSPHAERE]
Thomas Boehlen and Reiner Eiden *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 222-223 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

One-dimensional models for studying the effect of aerosol particles on the energy budget are described. Results of the study are described for atmospheric radiation in the solar and in the terrestrial spectral range. ESA

N78-11629 Freiburg Univ. (West Germany). Inst. fuer Geographie I.
AIR AND SURFACE TEMPERATURE DISTRIBUTION ON LARGE TERRACES DURING RADIATION NIGHTS [LUFT- UND OBERFLAECHENTEMPERATURVERTEILUNG AUF GROSSTERRASSEN IN STRAHLUNGSNAECHTEN]
Wilfried Endlicher *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 224-225 refs In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

The nocturnal temperature of modified large terraces was investigated using airborne infrared scanners and air temperature measurements. Resulting equidensity thermal pictures are presented and discussed. ESA

N78-11630 Bundesgesundheitsamt, Berlin (West Germany).
FORECASTING OF POSSIBLE INDUSTRIAL EMISSION BASED ON IMMISSION CLIMATOLOGICAL BOUNDARY VALUES [VORHERSAGE MOEGLICHER INDUSTRIE-EMISSIONEN UNTER VORLAGE IMMISSIONSKLIMATOLOGISCHER GRENZWERTE]
W. Fett and H. Fortak *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 226-227 ref In GERMAN (For availability see N78-11566 02-47)
Avail: Issuing Activity

A prognosis of the immission climatology for the coastal area near a planned sea harbor was carried out using propagation calculation. The effects of all basic source configurations were determined by simulation. A solution, optimal in regard to environmental protection, was found in case of a unified overall source intensity of contaminants, for industrialization of the harbor area. ESA

N78-11631 Freiburg Univ. (West Germany). Inst. fuer Geographie I.
SURFACE AND AIR TEMPERATURE BETWEEN THE BLACK FOREST AND THE UPPER RHINE PLAIN [OBERFLAECHEN- UND LUFTTEMPERATUREN ZWISCHEN SCHWARZWALD UND OBERRHEINEBENE]
Hermann Gossmann *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 228-229 ref In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

The thermal exchange between the surfaces of the Black Forest slopes and the air of the free upper Rhine plain was investigated using balloon sounding, terrestrial temperature measurement, and infrared thermal images. Results are presented and discussed. ESA

N78-11632 Max-Planck-Institut fuer Chemie, Mainz (West Germany).

DETERMINATION OF ATMOSPHERIC TURBIDITY FROM THE TRACE OF A SUNSHINE AUTOGRAPH [BESTIMMUNG DER ATMOSPHAERISCHEN TRUEBUNG AUS DER BRENNSPUR DES SONNENSCHEINAUTOGRAPHEN]

Ruprecht Jaenicke *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 230-231 refs In GERMAN; ENGLISH summary (For availability see N78-11566 02-47)

Avail: Issuing Activity

The determination of the atmospheric turbidity factor from the time span between astronomical and recorded sunrise/sunset on cloudless days is described. It is then possible to use the existing network and the available observation series for the determination of long-term trends and consequences on the climate. Author (ESA)

N78-11633 Deutscher Wetterdienst, Offenbach am Main (West Germany).

CAN IR SCANNER DATA BE USED TO DETERMINE AIR TEMPERATURES AT 2 METER HEIGHT? [KOENNEN MIT HILFE VON IR-SCANNER-DATEN LUFTTEMPERATUREN IN ZWEI METER HOEHE BESTIMMT WERDEN?]

P. M. Keuler *In its* Annals of Meteorol. No. 12 1977 p 232-234 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

The question as to whether temperatures at 2 m height can be determined from radiation temperatures of surfaces was investigated using airborne IR scanners. It was found that the temperature gradient is a function of the soil and the wind velocity, and the IR pictures cannot be used for determining absolute values. ESA

N78-11634 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

CONCEPT FOR AN AIRBORNE MULTIDISCIPLINARY LIDAR SYSTEM [KONZEPT FUER DEN FLUGZEUGEINSATZ EINES MULTIDISZIPLINAEREN LIDAR-SYSTEMS]

W. Renger and G. H. Ruppersberg *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 234-235 refs In GERMAN; ENGLISH summary (For availability see N78-11566 02-47)

Avail: Issuing Activity

It is planned to operate a combination of an aerosol and a differential absorption lidar onboard a meteorological research aircraft for different model-missions within the Federal Republic of Germany. These missions, which have nearly the same difficulties and solutions as future Spacelab experiments, shall demonstrate to which degree the intended objectives may be met. In cooperation with different groups actual problems shall be treated at the regional scale: Three-dimensional extent of haze and smog and penetrating plumes; detection of fresh air channels; mass concentration and mass fluxes of aerosols; detection of increased emission of bad or toxic substances; comparison to ground data; immission control of different spurious gases; and verification of models for simulation. Author (ESA)

N78-11635 Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany). Inst. fuer Meteorologie und Geophysik.

DIFFERENCES IN SHORT TERM VARIATIONS OF THE AIR TEMPERATURE [UNTERSCHIEDE IM KURZZEITIGEN VERLAUF DER LUFTTEMPERATUR]

Heinz Wachter *In* Deut. Wetterdienst Annals of Meteorol. No. 12 1977 p 236-237 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

The usefulness of inertialess temperature measurement for recording rapid temperature variation in the fields of microclimatology, turbulence research, and bioclimatology is discussed. ESA

N78-11636 Deutscher Wetterdienst, Hamburg (West Germany).

THE ORIGIN OF SUMMER HAZE [ZUM VERSTAENDNIS DES SOMMERDUNSTES]

Peter Winkler *In its* Annals of Meteorol. No. 12 1977 p 238-239 refs In GERMAN (For availability see N78-11566 02-47)

Avail: Issuing Activity

The analysis of data on the concentration of optically active large aerosol particles shows that high temperatures contribute to the origin of haze periods in summer. Since plants produce ethereal oils increasingly at higher temperatures and release these into the atmosphere, and these compounds form aerosols, a large area natural production mechanism of aerosol particles is indicated. Temperatures should be over 20 C. ESA

N78-11637*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

GROUND WINDS AND WINDS ALOFT FOR EDWARDS AFB, CALIFORNIA

D. L. Johnson and S. C. Brown Sep. 1977 258 p refs (NASA-TM-78136) Avail: NTIS HC A12/MF A01 CSCL 04B

Ground level runway wind statistics cover crosswind, tailwind, and headwind reversal percentage frequencies with respect to month and hour for the two major runways. Also presented are bivariate normal wind statistics for a 90 degree flight azimuth for altitudes 0 through 27 km. Wind probability distributions, synthetic vector wind profiles, and statistics for any rotation of axes are computed from five given parameters. Author

N78-11638*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

THUNDERSTORM RESEARCH INTERNATIONAL PROGRAM (TRIP 77) REPORT TO MANAGEMENT

Angelo J. Taiani Nov. 1977 44 p (NASA-TM-74740; KSC-TR-1556) Avail: NTIS HC A03/MF A01 CSCL 04B

A post analysis of the previous day's weather, followed by the day's forecast and an outlook on weather conditions for the following day is given. The normal NOAA weather charts were used, complemented by the latest GOES satellite pictures, the latest rawinsonde sounding, and the computer-derived thunderstorm probability forecasts associated with the sounding. Author

N78-11639*# Management and Technical Services Co., Beltsville, Md.

THE NIMBUS 6 DATA CATALOG. VOLUME 6: DATA ORBITS 4339 THROUGH 5155 Progress Report, 1 May - 30 Jun. 1976

May 1977 359 p (Contract NAS5-23740) (NASA-CR-155232) Avail: NTIS HC A16/MF A01 CSCL 04B

Satellite operations from launch through 14 July (orbit 425) consisted of engineering evaluation of all spacecraft systems. As a result of that effort, data reception, accountability and processing were intermittent during that period. During orbit 4905 (12 June), Nimbus 6 successfully completed one year operations. A summary of the documentation for each Nimbus 6 Data Catalog volume is presented. The pitch of the Nimbus 6 satellite has been made to alternate between +2.0 degrees, -0.6 degrees, and 0.0 degrees since launch. A positive pitch angle of 0.6 degrees moves the nadir-looking position 11.5 kilometers ahead of the subsatellite point. A positive pitch angle of 2.0 degrees moves the nadir-looking position 38.3 kilometers ahead of the subsatellite point. At these pitch angles, a scanner-type instrument no longer scans the earth along a great circle arc through the subpoint, but scans along the small circle formed by the intersection of the scan plane with the earth. Since the plane of the small circle is tilted with respect to the nominal scan plane, points on the arc are displaced farther from the great circle as the scan angle increases. As noted above, a pitch angle of 0.6 degrees causes a displacement of 11.5 kilometers at nadir, but when the scanner turns 45 degrees away from nadir the displacement increases slightly to 12.8 kilometers. Similarly, for a 2.0 degree pitch the displacement is 38.3 kilometers at nadir and increases to 42.6 kilometers at a 45 degree scan angle. Thus, although the instrument records in lines normal to the orbit plane (in the absence of yaw) the perpendicular displacement from the

perfect-attitude scan line is not uniform across the scan line. Author

N78-11640# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
WIND SHEAR CHARACTERIZATION Final Report, Apr. 1976 - Jan. 1977
G. E. Greene, Harold W. Frank, Alfred J. Bedard, Jr., J. Ann Korrell, Mary M. Cairns, and Peter A. Mandics Feb. 1977 132 p refs
(Contract DOT-FA76WAI-622)
(AD-A043391; FAA-RD-77-33) Avail: NTIS HC A07/MF A01 CSCL 04/2

Low level wind shear review indicates that the thunderstorm gust front is the most dangerous source of potential aircraft accidents. Analytical results of several gust front events using meteorological tower, acoustic echo sounder, and pressure sensor data were compared with theoretical models and laboratory studies. It is shown that gust fronts can be detected reliably with a suitable array of different ground-based sensors. However, the determination of wind shear severity is a more difficult problem. The results thus far show a promising relationship between gust front speed of motion and maximum shear. Author

N78-11641*# Maryland Univ., College Park. Meteorology Program.
INVESTIGATIONS WITH SATELLITE DATA. 2: TEMPERATURE RETRIEVALS Final Report, 1 Oct. 1976 - 1 Oct. 1977
Sigmund Fritz Oct. 1977 32 p refs
(Grant NsG-5084)
(NASA-CR-155256; Publ-77-174) Avail: NTIS HC A03/MF A01 CSCL 04B

A method for retrieving atmospheric temperatures in a severe storm situation was investigated. Retrieval was accomplished through the aid of satellite radiance measurements and nearby radiosondes. A set of coefficients was derived which when multiplied by the measured radiances, yielded smaller temperature retrieval errors than the minimum-information retrieval method. Author

N78-11642*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT OF A PROCEDURE TO MODEL HIGH-RESOLUTION WIND PROFILES FROM SMOOTHED OR LOW-FREQUENCY DATA
Dennis W. Camp Washington Nov. 1977 92 p refs
(NASA-TP-1071; M-239) Avail: NTIS HC A05/MF A01 CSCL 04B

The derivation of simulated Jimsphere wind profiles from low-frequency rawinsonde data and a generated set of white noise data are presented. A computer program is developed to model high-resolution wind profiles based on the statistical properties of data from the Kennedy Space Center, Florida. Comparison of the measured Jimsphere data, rawinsonde data, and the simulated profiles shows excellent agreement. Author

N78-11643# Air Force Geophysics Lab., Hanscom AFB, Mass.
A STUDY OF THE ERROR OF DISCRETIZATION IN THE AIR FORCE GLOBAL WEATHER CENTRAL BOUNDARY LAYER MODEL
Chien-Hsiung Yang 19 Apr. 1977 21 p
(AF Proj. 2310)
(AD-A042668; AFGL-TR-77-0091; AFGL-AFSG-367) Avail: NTIS HC A02/MF A01 CSCL 04/2

The computational structure in the vertical of the Air Force Global Weather Central Boundary Layer Model is analyzed. The approach used is to measure the degree of inaccuracy in the numerical solution of a time-dependent problem by the error of the steady-state solution incurred through discretization procedures. It is found that the present structure contains defects that are amenable to improvements that can be implemented without a substantial increase in computational effort. GRA

N78-11644# Air Force Geophysics Lab., Hanscom AFB, Mass.
INVESTIGATION OF COMPOSITE CLOUD FIELDS AS APPLIED TO TROPICAL STORM FORECASTING Final Report
Thomas J. Keegan 13 Jun. 1977 15 p refs
(AD-A043026; AFGL-TR-77-0136; AFGL-ERP-599) Avail: NTIS HC A02/MF A01 CSCL 04/2

This report reviews the work reported earlier in AFGL-TR-76-0170, Cloud Distributions as Indicators of Tropical Storm Displacement, by the same author, on the application of composite cloud imagery to the forecasting of tropical storm motion. Several additional techniques that were tested briefly for application to typhoon specification and forecasting are discussed and evaluated. Animations of 12-hour infrared images did not suggest anything useful within the limited time available for analysis. The technique, however, should be comprehensively tested with data of better time and spatial resolution. Infrared composites appeared to be less useful than visual composites. The increased detectability of thin cirrus clouds in the infrared masked the significant cloud features. An attempt to duplicate Dvorak's relationships between peak wind speed and the central and banding features of typhoons by compositing storms of similar intensity failed. The fine details Dvorak could distinguish in individual storms were destroyed by the compositing process. Objective analysis of satellite imagery of typhoons is seriously handicapped by the limited archive of digital data. Author (GRA)

N78-11645# Wisconsin Univ., Madison. Dept. of Meteorology.
ROLE OF TURBULENT MIXING IN THE DISPERSION OF POLLUTANTS AT THE EDGE OF A LARGE LAKE Final Project Report, 1 Jun. 1974 - 30 Nov. 1976
Ronald J. Dobosy and David D. Houghton 4 Mar. 1977 177 p refs
(Grants NOAA-04-4-022-33; NSF ATM-75-03617)
(PB-270383/3; NOAA-77062704) Avail: NTIS HC A09/MF A01 CSCL 04B

Simulation of pollutant dispersion and mixed layer development in a shoreline fumigation regime was studied using a two dimensional vertical plane model employing, depending on the experiment, level two or level three from the hierarchy of turbulence closure schemes. A one dimensional version of the model using hierarchy level three which includes nonlocal effects in the turbulence simulation was verified. Levels two and three were then compared using the two dimensional model under conditions as measured at Waukegan, Ill. Predictions from level two, a simpler and purely local scheme, are comparable to level three for both pollutant concentration and mixed layer depth at least with winds about 3 m/s, except within 500 m of shore and for a short distance above the inversion base. GRA

N78-11646# National Oceanic and Atmospheric Administration, Boulder, Colo. Weather Modification Program Office.
WEATHER MODIFICATION PROGRAM OFFICE COLLECTED REPRINTS, 1975-1976
May 1977 683 p refs
(PB-270307/2; NOAA-77062728) Avail: NTIS HC A99/MF A01 CSCL 04B

Abstracts are included of papers published in the NOAA Technical Report and Technical Memorandum series. The organizational groups within the program are the instrumentation Task Force, the Boundary Layer Dynamics Group, The Research Facilities Center, and the National Hurricane and Experimental Meteorology Laboratory. Reprints in this collection are arranged alphabetically by author within organizational group. GRA

N78-11647# Maryland Univ., College Park. Meteorology Program.
AN INTERCOMPARISON OF SATELLITE IMAGES AND RADAR RAINFALL RATES Final Report
Nancy Cheng and David Rodenhuis Apr. 1977 69 p refs
(Grant NOAA-04-4-158-48)
(PB-270299/1; NOAA-77062709) Avail: NTIS HC A04/MF A01 CSCL 04B

Digitized NOAA-2 visible and infrared data were compared with the observations of WSR-57 10 cm radar for 1041 AM June 28, 1973 in the Miami area. The linear correlation coefficients between satellite and radar data ranged from 0.23 to 0.34 for visible, 0.17 to 0.27 for infrared. The correlation could not be improved by considering only a fraction of the satellite image data above a threshold value. That is, the overlapping area ratios between satellite images and radar echoes ranged from 44% to

73% for the visible and slightly smaller (41% to 63%) for the infrared. When only the area of the radar echo is considered, the area ratios could be increased to an average of 75% (visible) and 71% (infrared). GRA

N78-11648# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
DESIGN OF AN AXISYMMETRIC PRIMITIVE EQUATION TROPICAL CYCLONE MODEL
James J. Hack and Wayne H. Schubert Dec. 1976 76 p refs
(Grants NSF DES-74-11438; NSF OCD-74-21678)
(PB-268813/3; AS-Paper-263) Avail: NTIS HC A05/MF A01 CSCL 04B

The parameterization of convective scale vertical transports of heat, moisture, and momentum follow the theory presented by Arakawa and Schubert. The equations of the theory are grouped into three parts: feedback, static control, and dynamic control. The dynamic control is formulated in terms of a linear programming problem which is solved by the simplex method. The space differencing schemes used in the model follow those developed by Arakawa and are designed such that the discrete analogues of certain integral contraints are maintained. GRA

N78-11649# Honeywell, Inc., Hopkins, Minn. Defense Systems Div.
MINIATURE METEOROLOGICAL BALLOONSONDE Final Summary Report, 30 Jun. 1976 - 1 Feb. 1977
C. Motchenbacher 3 Jun. 1977 132 p refs
(Contract N62269-76-C-0368)
(AD-A043300; NADC-76129-30) Avail: NTIS HC A07/MF A01 CSCL 04/2

The purpose of this program was to demonstrate that it is possible to build a light-weight miniature meteorological sonde (minisonde) which can be borne aloft by a 30-gram latex balloon. During this program, 85-gram minisondes were built and successfully launched with 30-gram balloons. The program was broken down into two parts- the assembly of five minisondes and the launching/data reduction for these minisondes. The construction of a small, light-weight minisonde requires that new miniature sensors and high-efficiency electronics be used. For temperature measurements, the standard rod thermistor was selected. For humidity measurement, the conventional VIZ carbon hygristor was used. For pressure measurement, a Honeywell silicon diaphragm barometer was used. To commutate between the temperature, pressure, and humidity sensors and encode the meteorological data measurements, a set of meteorological electronics was developed using commerically available integrated circuits. A special light-weight telemetry transmitter providing an output of 1/2 watt at 400 to 406 megahertz was designed and constructed. Power for the transmitter and minisonde electronics was provided by a small flat disc battery using lithium electrochemical technology. Three minisondes were launched using 30-gram latex balloons and rose to an altitude of greater than 15,000 feet at a rise rate of approximately 600 feet per minute. During the flight, temperature, pressure, and humidity data were successfully telemetered back to an FM receiver located on the ground. Author (GRA)

N78-11650# Florida State Univ., Tallahassee. Dept. of Statistics.
DATA SUMMARIZATION IN A WEATHER MODIFICATION EXPERIMENT. 1: A RESPONSE SURFACE APPROACH
Ralph A. Bradley, Sushil S. Srivastava, and Adolf Lanzdorf Jun. 1977 81 p refs
(Contract N00014-76-C-0394)
(AD-A043485; FSU-Statistics-M417; ONR-TR-117) Avail: NTIS MF A01 CSCL 04/2

This paper reports on one of a series of investigations on summarization of precipitation data in weather modification experiments. A response surface approach is used with raingage location coordinates as independent variables. The method is applied to data made available by North American Weather Consultants from Phase I of their Santa Barbara Convective Test Seeding Program. After investigations, two-dimensional general cubic functions were used to describe precipitation response. These surfaces were integrated to produce total precipitation measurements over designated target areas of interest and the variances of such estimates were obtained. Advantages of the approach lie in the flexibility of the choice of target area and the permissible variation in the impact area of a particular convective band. Author (GRA)

N78-11651# Control Data Corp., Minneapolis, Minn. Research Div.
PERIODIC WIND VARIATIONS AT 65-118 km AT SASKATOON (52N) Final Report, Apr. 1976 - Apr. 1977
A. D. Belmont, G. D. Nastrom, and D. N. Hovland 26 May 1977 40 p refs
(AD-A043305; AFOSR-77-0967TR) Avail: NTIS HC A03/MF A01 CSCL 04/1

Periodic time analyses of radio reflection winds from 65-118 km at Saskatoon (52 deg N), 1969-1976, confirm component waves' amplitudes and phases previously found by meteor-wind radar data at highest altitudes. These analyses also provide values down to meteorological rocket altitudes. The newest information is that the semiannual wave progresses downward at a very constant rate of 8 km/month from 118 to 70 km. The semiannual phase dates suggest that this wave may be caused by either or both (1) the influence of auroral particle precipitation maxima on heating by eventual effects on ozone, or (2) the influence of heating at high latitudes during sudden warmings. A three-month wave, also found, has twice the rate of phase progression as the semiannual wave. Significant spectral peaks are found near a period of 5 days, particularly in summer. At least half of the variance of data spaced at five-minute intervals is associated with variations of period less than about one-half hour, suggesting that sampling should be performed at the highest possible frequency. GRA

N78-11652# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC TEMPERATURE IN BELGIUM [LA TEMPERATURE DE L'AIR EN BELGIQUE]
A. Bodeux 1976 118 p In FRENCH and DUTCH
(Misc-Ser-B-39) Avail: NTIS HC A06/MF A01

The temperature at synoptic hours, the maximal diurnal temperatures, and the minimal nocturnal temperatures are tabulated for various synoptic weather stations in Belgium. Data reported include daily value distribution, monthly normalized values, and the mean deviation in relation to Uccle station. ESA

N78-11653# World Meteorological Organization, Geneva (Switzerland).
GUIDELINES FOR DISASTER PREVENTION AND PREPAREDNESS IN TROPICAL CYCLONE AREAS
1977 135 p refs Prepared jointly with Econ. and Social Comm. for Asia and the Pacific and League of Red Cross Soc. Avail: NTIS HC A07/MF A01; WMO, Geneva

Following a general introduction and background information, forecasts and warnings of tropical cyclones, river floods, and storm surges are reviewed. The role of disaster prevention in national planning is discussed together with legislation for disaster prevention, risk evaluation, land use, and zoning and building codes. Planning and legislation for disaster preparedness are summarized along with aspects such as tropical cyclone warning systems, flood fighting, evacuation of danger areas, public education and information, and test exercises and emergency operations. Finally, disaster rehabilitation and resettlement and assessment of damage are discussed. ESA

N78-11654# Royal Netherlands Meteorological Inst., De Bilt.
CALCULATION OF THE GEOSTROPHIC WIND [BEREKENING VAN DE GEOWIND]
G. J. Cats 1977 53 p refs In DUTCH; ENGLISH summary
(KNMI-WR-77-2) Avail: NTIS HC A04/MF A01

A method for calculating the geostrophic wind from synoptic air pressure observations in the Netherlands is presented. The method smoothers the observed air pressure values by means of a principal components analysis and interpolates the principal components by means of a simple two-dimensional Taylor series. Probably the method leads to a root mean square deviation of 0.5 m/s in the length and of 5 deg in the direction of the geostrophic wind. Using the principal components analysis a procedure was developed to complete missing pressure observations. The principal components analysis was further used to estimate the 10-meter wind from the air pressure observations.

Without taking instationarity effects into account yet, this appeared possible for the 'De Bilt' (06260) station with a root mean square (rms) error of 1.5 m/s and for the 'Zestienhoven' (06344) station with a rms error of 1.9 m/s in both horizontal wind components, corresponding to a rms error of 1.2 and 1.8 m/s in the length and 24 deg and 24 deg in the direction of the 10-meter wind in De Bilt and Zestienhoven, respectively.
Author (ESA)

N78-11655# Royal Netherlands Meteorological Inst., De Bilt.
ON THE EXPLANATION OF PERSISTENCE IN THE MONTHLY AVERAGE TEMPERATURE [OVER DE VERKLARING VAN PERSISTENTIE IN DE MAANDGEMIDDELDE TEMPERATUUR]
H. M. VanDenDool 1977 21 p refs In DUTCH
(KNMI-V-284) Avail: NTIS HC A02/MF A01

Persistence in the monthly average temperature, i.e., the chance of continuation of a temperature anomaly being greater than can be expected, was investigated. One possible factor is the direct influence of anomalous thermal conditions in the atmospheric boundary layer near the place of measurement, for instance a too warm North Sea. This direct influence was investigated using sea water temperatures near the light ship Texel and air temperatures at Den Helder, De Bilt, and Beek in the Netherlands. It is concluded that there is a small contribution from the three land stations to the persistence under study because the sea functions as external memory. This effect is strongest at Den Helder. Consequently, the month-to-month persistence is greatest at Den Helder. In several months quite reasonable persistence predictions for Den Helder can be made for the following month. ESA

N78-11656# Royal Netherlands Meteorological Inst., De Bilt.
VERIFICATION TESTS OF THE OPERATIONAL BK3 MODEL WITH THE AID OF AN ESPECIALLY DEVELOPED DATA-SET [VERIFICATIETEST MET HET OPERATIONELE BK3 MODEL MET BEHULP VAN EEN HIERVOOR ONTWIKKELDE DATA-SET]
J. H. A. Bernard, J. D. Opsteegh, and S. Steel 1977 23 p In DUTCH
(KNMI-V-285) Avail: NTIS HC A02/MF A01

The BK3 atmospheric circulation model was verified using a semi-objective quantitative numerical prognosis method. The procedure of selecting 50 cases satisfying the required criterions is described, and testing of the operational BK3 model on the data set is discussed. It was found that the BK3 model moves pressure systems systematically too slow, that for depression nuclei a systematic failure in northern direction occurs, that the depression nuclei are systematically filled up too much, and that the correlation between predicted and empirical filling up is bad. Suggestions for improving the BK3 model are made. ESA

N78-11657# Royal Netherlands Meteorological Inst., De Bilt.
WEATHER FORECASTING FOR THE BUILDING INDUSTRY DURING WINTER 1975-1976 [RAPPORT BETREFFENDE DE WEERBERICHTGEVING VOOR DE BOUWNIJVERHEID IN DE WINTER 1975-1976]
J. J. Allan, A. P. A. Kleintjes, and D. M. VanDerWoude 1977 24 p In DUTCH
(KNMI-V-286) Avail: NTIS HC A02/MF A01

Details on measured temperature, precipitation, wind and weather phases (ranges of average 24 hr temperatures in the Netherlands from 2 November 1975 to 31 March 1976 are given. Weather forecasts are compared with the actual outcome. Organization of the weather forecast procedure (by telephone) for the building industry is presented and an analysis of the use made of the system is given. ESA

N78-11658# Washington Univ., Seattle. Cloud Physics Group.
AEROSOL OVER THE HIGH PLAINS OF THE UNITED STATES Final Report
Peter V. Hobbs, David A. Bowdle, and Lawrence F. Radke Feb. 1977 149 p refs
(Contract DI-14-06-D-7664)
(PB-268868/7; RR-12) Avail: NTIS HC A07/MF A01 CSCL 04B

A detailed airborne study of the nature of the aerosol is carried out. The patterns of variation of aerosol concentrations within the mixing layer over the High Plains depend on the type of air mass, the proximity of the aerosol sources and sinks, and the size and type of aerosol. Volume and surface area distributions of aerosol, from 0.01 to 100 micrometers in diameter, were distinctly bi-modal over a wide range of meteorological conditions. Most of the aerosol surface area was contained in particles between 0.1 and 1.0 micrometer in diameter, and most of the volume in particles from 10-20 micrometers in diameter. Background concentrations of cloud condensation nuclei active between 0.2 and 1.5% supersaturation, and aerosol between 0.1 and 10 micrometers in diameter, varied with air mass age on a synoptic scale. GRA

N78-11659# Western Scientific Services, Inc., Fort Collins, Colo.
DEVELOPMENT OF AN EXPERIMENTAL HYDROMETEOROLOGICAL DATA COLLECTION NETWORK Final Report, 1 Jul. 1974 - 30 Apr. 1977
James H. Wagner 30 Apr. 1977 190 p
(Contract DI-14-06-D-7551)
(PB-270265/2; FR-807-55) Avail: NTIS HC A09/MF A01 CSCL 04B

The development of an automatic microprocessor based data collection system is described. It uses VHF telemetry links capable of collecting hydrometeorological data from remote sites distributed over a wide area or in relatively inaccessible terrain. Results of an extensive test program are included along with recommendations for improving the reliability and performance of the system. Detailed schematics for all equipment developed are provided and the operation of each piece of equipment is described. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N78-11660# Washington Univ., Seattle. Dept. of Oceanography.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. DATA REPORT 35: JOINT II-R/V THOMAS G. THOMPSON CRUISE 108, BOTTLE DATA APRIL - JUNE 1976
L. A. Codispoti, D. D. Bishop, M. A. Friebertshauser, and G. E. Friedrich Dec. 1976 375 p refs
(Grants NSF OCE-76-01309; NSF OCE-76-04825)
(PB-268901/6; NSF/IDOE-77-106) Avail: NTIS HC A16/MF A01 CSCL 08J

The work of the Coastal Upwelling Ecosystems Analysis group (CUEA) supported by the International Decade of Ocean Exploration Program (IDOE), is described.. As part of this effort hydrographic stations were taken from the R/V THOMAS G. THOMPSON during April-June 1976. This report presents and discusses the quality of the Niskin bottle data taken at these stations. GRA

N78-11661# National Oceanic and Atmospheric Administration, Seattle, Wash. Office for the International Decade of Ocean Exploration.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. DATA REPORT 36: STD MEASUREMENTS OFF SPANISH SAHARA, MARCH/APRIL 1974
David Halpern and R. Holbrook Jan. 1977 323 p
(PB-268963/6; NSF/IDOE-77-107) Avail: NTIS HC A14/MF A01 CSCL 08J

Summaries of STD measurements recorded during March and April 1974 off northwest Africa are presented in computer-generated output as vertical profiles of temperatures, salinity and sigma-T as tables containing values of temperature, salinity, sigma-T and dynamic height anomaly at selected depths. Meteorological conditions associated with each set of measurements are presented. These measurements were made during the Coastal Upwelling Ecosystems Analysis experiment called JOINT-1. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N78-11662*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF WEIGHTLESSNESS CONDITIONS ON THE SOMATIC EMBRYOGENESIS IN THE CULTURE OF CARROT CELLS

R. G. Butenko, N. N. Dmitriyeva, V. Ongko, and L. V. Basyrova Aug. 1977 20 p refs Transl. into ENGLISH of "Vliyaniye Usloviy Nevesomosti na Somaticheskiy Embriogenez v Kul'ture Kletok Morkovi", Moscow, Acad. of Sci. of the USSR, 1977 p 7-18 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-2790)

(NASA-TM-75040) Avail: NTIS HC A02/MF A01 CSCL 06C

A carrot cell culture seeded in Petri dishes in the United States and transported to the USSR was subjected to weightlessness for 20 days during the flight of Kosmos 782. The controls were cultures placed on a centrifuge (1 g) inside the satellite and cultures left on ground in the U.S.S.R. and the United States. A count of structures in the dishes after the flight showed that the number of developing embryonic structures and the extent of their differentiation in weightlessness did not reliably differ from the number and extent of differentiation in structures developed on the ground. Structures with long roots developed in weightlessness. Analysis of the root zones showed that these roots differed by the increased size of the zone of differentiated cells. The increased size of the zones of differentiated cells can indicate earlier development of embryonic structures. Author

N78-11663*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE USE OF NONHUMAN PRIMATES IN SPACE

Richard C. Simmonds, ed. and Geoffrey H. Bourne, ed. (Emory Univ.) Sep. 1977 390 p refs Proc. held at Moffett Field, Calif., 2-4 Dec. 1974

(NASA-CP-005; A-6133) Avail: NTIS HC A17/MF A01 CSCL 06C

Space related biomedical research involving nonhuman primates is reviewed. The scientific assets of various species and the instruments used for monitoring physiological processes during long duration experimentations are described. For individual titles, see N78-11664 through N78-11680.

N78-11664*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A REVIEW OF ANIMAL FLIGHT EXPERIMENTS

Harold Sandler *In its* The Use of Nonhuman Primates in Space Sep. 1977 p 3-21 refs (For availability see N78-11663 02-51)

Avail: NTIS HC A17/MF A01 CSCL 06C

Extensive experience with biologic systems was obtained with a variety of vertebrate species over the past 18 years. Subhuman primates were precursors to man in the American space flight program; dogs and mice were animals of choice for the Soviet program. Recent attempts to use heavily instrumented animals for observations of long-term physiological effects indicate problems which must be correctedd in future experiments for monitoring the effects of environmental stresses over the longer periods required for accomplishing meaningful habitation in near-Earth orbit or for travel to nearby planets.

Author

N78-11665*# California Univ., Berkeley.

PHYSIOLOGICAL STUDIES IN SPACE WITH NONHUMAN PRIMATES USING THE MONKEY POD

N. Pace, D. F. Rahlmann, A. M. Kodama, R. C. Mains, and B. W. Grunbaum *In* NASA. Ames Res. Center The Use of Nonhuman Primates in Space Sep. 1977 p 23-49 refs (For availability see N78-11663 02-51)

Avail: NTIS HC A17/MF A01 CSCL 06C

A completely enclosed module was constructed for continuously maintaining an unanesthetized adult 10-12 kg monkey in a physiologically stable state of comfortable restraint for periods of at least 10 days, either on the ground or in an orbiting spacecraft. Energy balance determinations made during three different tests using a giant rhesus (malaca nemestrina) are presented in charts and graphs. Author

N78-11666*# Emory Univ., Atlanta, Ga. Yerkes Regional Primate Research Center.

THE ORBITING PRIMATE EXPERIMENT (OPE)

Geoffrey H. Bourne, M. Nelly Golarz DeBourne, and Harold M. McClure *In* NASA. Ames Res. Center The Use of Nonhuman Primates in Space Sep. 1977 p 51-82 refs (For availability see N78-11663 02-51)

Avail: NTIS HC A17/MF A01 CSCL 06C

Instrumentation and life support systems are described for an experiment to determine the physiological effects of long term space flight on unrestrained, minimally instrumented rhesus macaques flown in orbit for periods up to six months or one year. On return from orbit, vestibular, cardiovascular, and skeletal muscle function will be tested. Blood chemistry and hematological studies will be conducted as well as tests of the immunological competence of selected animals. Nasal, rectal, and throat swabs will be used for bacterial and viral studies, and histopathological and histochemical investigations will be be made of all organs using light and electron microscopy. The experiment is being considered as a payload for the biomedical experiment scientific satellite. A.R.H.

N78-11667*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CARDIOVASCULAR STUDIES IN THE RHESUS MONKEY

H. L. Stone (Texas Univ., Galveston) and H. Sandler *In its* The Use of Nonhuman Primates in Space Sep. 1977 p 83-101 refs (For availability see N78-11663 02-51)

Avail: NTIS HC A17/MF A01 CSCL 06C

Criteria are given for selecting the macaca mulatta as the analogue of the human in the study of cerebral circulation, particularly the control of the cerebral vascular bed during normal and stressful conditions. Topics discussed include surgical preparation of subject; responses to changes in arterial pressure, oxygen, and carbon dioxide; innervation of cerebral vessels; cerebral flow response to acceleration; and cerebral blood flow and cerebellar stimulation. A.R.H.

N78-11668*# Mayo Foundation, Rochester, Minn.

SOME EFFECTS OF ACCELERATION IN MAN AND CHIMPANZEES

E. H. Wood, D. J. Sass, E. L. Ritman, J. F. Greenleaf, C. M. Coulam, D. Nathan, and E. C. Nolan *In* NASA. Ames Res. Center The Use of Nonhuman Primates in Space Sep. 1977 p 103-164 refs (For availability see N78-11663 02-51)

(Grant NGR-24-003-001; Contract F44620-71-c-0069-Grants HL-04664)

Avail: NTIS HC A17/MF A01 CSCL 06C

Early physiologic experiments using dogs and humans in certrifuges are reviewed. Because of the close similarity between the shape and dimensions of the thoraces of chimpanzees and humans, the former were used to obtain roentgenograms and photokymographic recordings of multiple physiologic variables before and during exposure to +5.8 Gy to study the effects of changes in the gravitational-inertial force environment on the cardiovascular and pulmonary systems during long duration space flight. A computer-controlled sciscanning system was used to obtain a two dimensional map of the amount of radiation emanating from the dorsal and ventral surfaces after insertion of radioactive microspheres in the right ventricle. By using four different batches of microspheres tagged with isotopes of different energies, the spatial distribution of pulmonary blood flow under four conditions was determined. A.R.H.

N78-11669*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

BIORHYTHMS AND SPACE EXPERIMENTS WITH NONHUMAN PRIMATES

C. M. Winget *In its* The Use of Nonhuman Primates in Space Sep. 1977 p 165-177 refs (For availability see N78-11663 02-51)

Avail: NTIS HC A17/MF A01 CSCL 06C

Man's response to exposure to spaceflight and weightlessness is expressed in physiological adjustments which involve his health and ability to function. The amplitude and periodicity of fluctuations

in biological processes affect various functions and responses to provocative stimuli. Primates and other species are subjected to tests to determine the consequences of an altered biorhythm on work and performance, emotional stability, biomedical evaluation in space, the ability to cope with the unexpected, and susceptibility to infection, toxicity, radiation, drugs, and stress. Factors in the environment or operational setup which can change the physiological baseline must be determined and controlled. A.R.H.

N78-11670*# Emory Univ., Atlanta, Ga. Yerkes Regional Primate Research Center.

VESTIBULAR FUNCTIONS AND SLEEP IN SPACE EXPERIMENTS

Adrian A. Perachio *In* NASA. Ames Res. Center The Use of Nonhuman Primates in Space Sep. 1977 p 179-195 refs (For availability see N78-11663 02-51)

Avail: NTIS HC A17/MF A01 CSCL 06C

Physical indices of sleep were continuously monitored in an owl monkey living in a chamber continuously rotating at a constant angular velocity. The electrophysiological data obtained from chronically implanted electrodes was analyzed to determine the chronic effects of vestibular stimulation on sleep and wakefulness cycles. The interaction of linear and angular acceleration on the vestibulo-ocular reflex was investigated in three rhesus monkeys at various angular accelerations. Author

N78-11671*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

VETERINARY MEDICAL CONSIDERATIONS FOR THE USE OF NONHUMAN PRIMATES IN SPACE RESEARCH

Richard C. Simmonds *In its* The Use of Nonhuman Primates in Space Sep. 1977 p 197-201 refs (For availability see N78-11663 02-51)

Avail: NTIS HC A17/MF A01 CSCL 06C

The validity of biomedical research using animal subjects is highly dependent on the use of 'normal' and healthy animals. The current costs of research programs dictate that a minimum number of animals and test replicates be used to obtain the desired data. The use of healthy and standardized animals increases the probability of obtaining valid data while also permitting greater economy by reducing the between-individual variation, thus allowing the use of fewer animals. Areas of concern when planning animal payloads include constraints of the flight on candidate species selection, screening for physiological and psychological normalcy, procedures for routine care and quarantine of new animals and those returning from space, ground-based studies to determine experimental protocol, selection of instrumentation, stress during transportation for flight operations, housing and care facilities at launch and recovery sites, and the overall veterinary program. A.R.H.

N78-11672*# Howard Univ., Washington, D. C. Coll. of Medicine.

CARDIOVASCULAR STUDIES USING THE CHIMPANZEE (PAN TROGLODYTES)

Joseph E. Hinds, LaVal N. Cothran, and Edward W. Hawthorne *In* NASA. Ames Res. Center The Use of Nonhuman Primates in Space Sep. 1977 p 203-224 refs Prepared in cooperation with Emory Univ. (For availability see N78-11663 02-51)

Avail: NTIS HC A17/MF A01 CSCL 06C

Despite the phylogenetic similarities between chimpanzees and man, there exists a paucity of reliable data on normal cardiovascular function and the physiological responses of the system to standard interventions. Totally implanted biotelemetry systems or hardwire analog techniques were used to examine the maximum number of cardiovascular variables which could be simultaneously monitored without significantly altering the system's performance. This was performed in order to acquire base-line data not previously obtained in this species, to determine cardiovascular response to specific forcing functions such as ventricular pacing, drug infusions, and lower body negative pressure. A cardiovascular function profile protocol was developed in order to adjust independently the three major factors which modify ventricular performance, namely, left ventricular performance, left ventricular preload, afterload, and contractility. Cardiac pacing at three levels above the ambient rate was used to adjust end diastolic volume (preload). Three concentrations of angiotensin were infused continuously to evaluate afterload in a stepwide fashion. A continuous infusion of dobutamine was administered to raise the manifest contractile state of the heart. Author

N78-11673*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

INSTRUMENTATION FOR SPACE FLIGHT EXPERIMENTS c35

Ernest P. McCutcheon *In its* The Use of Nonhuman Primates in Space Sep. 1977 p 225-243 refs (For availability see N78-11663 02-51)

Avail: NTIS HC A17/MF A01 CSCL 14B

The selection of measurement systems for experiments conducted in the context of a space flight must be guided by the criteria applicable to any scientific study requiring objective measurements of physiological variables. Steps fundamental to the process of choosing the best instrumentation system are identified and the key factors in matching the operational characteristics of the instrumentation to its intended use are discussed. Special problems in obtaining data from nonhuman primates, whether restrained or unrestrained, are explored. Choices for data processing are evaluated as well as the use of prototype flight tests and simulations to assess future life science experiments for spacelab or payloads for the space shuttle biomedical scientific satellite. A.R.H.

N78-11674*# Emory Univ., Atlanta, Ga. Yerkes Regional Primate Research Center.

THE RHESUS MONKEY (MACACA MULATTA) AS A FLIGHT CANDIDATE

M. Nelly Golarz DeBourne, Geoffrey H. Bourne, and Harold M. McClure *In* NASA. Ames Res. Center The Use of Nonhuman Primates in Space Sep. 1977 p 245-279 refs (For availability see N78-11663 02-51)

Avail: NTIS HC A17/MF A01 CSCL 06C

The intelligence and ruggedness of rhesus monkeys, as well as the abundance of normative data on their anatomy, physiology, and biochemistry, and the availability of captive bred animals qualify them for selection as candidates for orbital flight and weightlessness studies. Baseline data discussed include: physical characteristics, auditory thresholds, visual accuity, blood, serological taxomony, immunogenetics, cytogenics, circadian rhythms, respiration, cardiovascular values, corticosteroid response to charr restraint, microscopy of tissues, pathology, nutrition, and learning skills. Results from various tests used to establish the baseline data are presented in tables. A.R.H.

N78-11675*# Texas Univ., Bastrop. Cancer Center.

THE CHIMPANZEE AS A FLIGHT CANDIDATE

In NASA. Ames Res. Center The Use of Nonhumans in Space Sep. 1977 p 277-279 refs (For availability see N78-11663 02-51)

Avail: NTIS HC A17/MF A01 CSCL 06C

Some of the characteristics that make the chimpanzee an attractive animal model (anatomy, size, intelligence, and durability) also create some very unique problems. The universally recognized problems of availability and expensive maintenance, combined with the often underestimated problems associated with routine housing, husbandry, restraint, and medical management, severely limit the availabe avenues of approach. Problems involved in using implantable, multichannel radiotelemetry systems to monitor cardiodynamics in chimpanzees are discussed. Author

N78-11676*# Tulane Univ., New Orleans, La.

THE SQUIRREL MONKEY AS A CANDIDATE FOR SPACE FLIGHT

Kenneth R. Brizzee, J. Mark Ordy, and Bernice Kaack *In* NASA. Ames Res. Center The Use of Nonhuman Primates in Space Sep. 1977 p 281-327 refs (For availability see N78-11663 02-51)

(Contract NCA2-800402; Grant RR0016413)

Avail: NTIS HC A17/MF A01 CSCL 06C

Because of its size and other unique diurnal-primate characteristics, the squirrel monkey is used in: (1) actual bioflight missions, (2) in laboratory tests designed to clarify the risks to man during launch and recovery as well as in hazardous spaceflight environments, and (3) in the acquisition of data on unknown risks encountered in long duration space exploration. Pertinent data concerning samiri sciureus as described in published and

unpublished reports are summarized. Topics include: taxonomy, ethology, life history, sensory-learning-motor capabilities in primate perspective, anatomy and physiology (including homeostatic adaptation to stress), susceptibility to environmental hazards, reproduction, care and clinical management, and previous use in aerospace biomedical research. A.R.H.

N78-11677*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE CAPUCHIN MONKEY AS A FLIGHT CANDIDATE
C. M. Winget *In its* The Use of Nonhuman Primates in Space Sep. 1977 p 329-342 refs (For availability see N78-11663 02-51)
Avail: NTIS HC A17/MF A01 CSCL 06C

The highly evolved nervous system and associated complex behavioral capabilities of the nonhuman primates make them good candidates for certain studies in the space environment since deleterious changes in these more complex aspects of a biological status can only be demonstrated by species which share such highly evolved features with man. Important assets which urge the selection of the capuchin monkey for space experiments include his small size, high intelligence, relative disease resistance, nutritional requirements, and lower volume life support systems. The species is particularly suited for experiments on the nervous system or on process under neural control because of the similarity of capuchin and human blood chemistry profiles and endocrine systems involved in the maintenance of homeostasis and vasomotor tone. A.R.H.

N78-11678*# California Univ., Berkeley.
THE PIG-TAILED MONKEY (MACACA NEMESTRINA) AS A SPACE-FLIGHT CANDIDATE
N. Pace, D. F. Rahlmann, A. M. Kodama, B. W. Grunbaum, and R. C. Mains *In* NASA. Ames Res. Center The Use of Nonhuman Primates in Space Sep. 1977 p 343-356 refs (For availability see N78-11663 02-51)
Avail: NTIS HC A17/MF A01 CSCL 06C

Scientific attributes which make the pig-tailed monkey an optimal candidate for studing the nature of cardiovascular and respiratory adaptations in man during exposure to high altitudes for long periods of time include: a calm, quiet, patient temperament; a short tail and the presence of ischial callosities permitting comfortable seated restraint during long duration experiments; and the close phylogenetic relationships and comparable body size to man. Author

N78-11679*# Emory Univ., Atlanta, Ga. Yerkes Regional Primate Research Center.
CONSIDERATION OF OTHER PRIMATE SPECIES AS FLIGHT ANIMALS
Geoffrey H. Bourne *In* NASA. Ames Res. Center The Use of Nonhuman Primates in Space Sep. 1977 p 357-378 (For availability see N78-11663 02-51)
Avail: NTIS HC A17/MF A01 CSCL 06C

The different types of primates which might be used as flight animals are surveyed, and the pros and cons of using them are discussed. Various factors suggest that the most desirable animals for space studies are the rhesus, pig-tailed, Java, and squirrel monkeys. The capuchin monkey has assets for certain types of space experimentation. Author

N78-11680*# School of Aerospace Medicine, Brooks AFB, Tex. Biodynamics Branch.
THE RHESUS (MACACA MULATTA) AND CRAB-EATING (MACACA FASCICULARIS) MONKEYS IN CARDIOVASCULAR AND AEROSPACE RESEARCH
H. H. Erickson and J. R. Ritzman *In* NASA. Ames Res. Center. The Use of Nonhumans in Space Sep. 1977 p 379-387 refs (For availability see N78-11663 02-51)
(NASA Order A-94544)
Avail: NTIS HC A17/MF A01 CSCL 06C

Two nonhuman primate species were used to investigate the effects of gravitoinertial forces on pilot incapacitation and performance impairment, to define human physiologic tolerance and safe exposure limits to these environments, and to obtain data which can be used to evolve new methods to improve man's G tolerance to match the structural capability of new generation aircraft. The macaca fascicularis was used to study the effects of environmental stress and atherosclerosis on cerebral blood flow and function agents on myocardial and cardiovascular function were studied in the macaca mulatta. Author

N78-11681# Civil Aeromedical Inst., Oklahoma City, Okla.
INHALATION TOXICOLOGY: 1. DESIGN OF A SMALL-ANIMAL TEST SYSTEM. 2. DETERMINATION OF THE RELATIVE TOXIC HAZARDS OF 75 AIRCRAFT CABIN MATERIALS Progress Report, Oct. 1974 - Sep. 1976
Charles R. Crane, Donald C. Sanders, Boyd R. Endecott, John K. Abbott, and Paul W. Smith Mar. 1977 59 p refs
(AD-A043646; FAA-AM-77-9) Avail: NTIS HC A04/MF A01 CSCL 06/20

A laboratory test system is described that utilizes small animals to evaluate the relative toxic hazard of combustion products generated by the thermal decomposition of nonmetallic materials. It includes: A discussion of the concepts that led to the design; detailed instructions for conducting a test; an evaluation of the system's performance as determined by the testing of 75 aircraft cabin materials; the utilization of animal response time as a basis for expressing relative toxicity; and a discussion of the derivation of an inhalation dose concept that promises to be more useful than lethal concentrations. Author

N78-11682# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: BIOMEDICAL SCIENCES
14 Oct. 1977 67 p refs Transl. into ENGLISH from Russian Journals
(JPRS-69970) Avail: NTIS HC A04/MF A01

Information on aerospace medicine, agrotechnology, bionics and bioacoustics, biochemistry, biophysics, environmental and ecological problems, food technology, microbiology, epidemiology and immunology, marine biology, military medicine, physiology, public health, toxicology, radiobiology, veterinary medicine, behavioral science, human engineering, psychology, psychiatry and related fields, and scientists and scientific organizations in biomedical fields is presented. Author

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N78-11683 California Univ., Berkeley.
ANALYSIS OF IRON CONTENT IN INDIVIDUAL HUMAN RED BLOOD CELLS BY ELECTRON MICROPROBE AND SCANNING ELECTRON MICROSCOPE Ph.D. Thesis
David Davis 1976 169 p
Avail: Univ. Microfilms Order No. 77-15652

The iron content of single human red blood cells was assessed using electron microprobe analysis and scanning electron microscopy. Two preparative procedures were tested: a whole blood smear preparation, and a fixed-washed cell preparation. Differences in Fe distribution among individual cells from both normal subjects and sickle cell anemia patients were measured. Iron K-irradiation distribution curves for both normal and sickle cell groups very closely approximated a normal probability curve; however, the sickle cell distribution contained a greater number of open classes than the normal group. Dissert. Abstr.

N78-11684 California Univ., Berkeley.
ACCUMULATED STRESS, RESERVE CAPACITY, AND DISEASE Ph.D. Thesis
Peter Alan Levine 1976 265 p
Avail: Univ. Microfilms Order No. 77-15760

The accumulation of stress on the reserve capacity of an organism was considered. Effects on the autonomic system, specifically the sympathetic and parasympathetic systems were studied. Relationships of these systems were described by the Catastrophe theory. Further studies were done surveying the blood pressure responses within a hospital population. Possibilities for presymptomatic diagnosis, whereby stress accumulation is detected before the development of debilitating symptoms and tissue pathologies, were investigated as well. Dissert. Abstr.

N78-11685*+ National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 171
Sep. 1977 66 p
(NASA-SP-7011(171)) Avail: NTIS HC E02 CSCL 06E

This bibliography lists 186 reports, articles, and other documents introduced into the NASA scientific and technical information system in August 1977. Author

N78-11686*+ National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 172
Oct. 1977 52 p
(NASA-SP-7011(172)) Avail: NTIS HC E02 CSCL 06E

This bibliography lists 132 reports, articles, and other documents introduced into the NASA scientific and technical information system in September 1977. Author

N78-11687*# National Aeronautics and Space Administration, Washington, D. C.
LIPID EXTRACTION FROM ISOLATED SINGLE NERVE CELLS
I. V. Krasnov Aug. 1977 13 p refs Transl. into ENGLISH from Tsitologiya (USSR), v. 15, no. 12, 1973 p 1535-1539 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by USSR Ministry of Public Health, Moscow.
(Contract NASw-2790)
(NASA-TM-75043) Avail: NTIS HC A02/MF A01 CSCL 06A

A method of extracting lipids from single neurons isolated from lyophilized tissue is described. The method permits the simultaneous extraction of lipids from 30-40 nerve cells and for each cell provides equal conditions of solvent removal at the conclusion of extraction. Author

N78-11688*# National Aeronautics and Space Administration, Washington, D. C.
TEMPERATURE DISTRIBUTION IN THE HUMAN BODY UNDER VARIOUS CONDITIONS OF INDUCED HYPERTHERMIA
O. V. Korobko, T. L. Perelman, and S. Z. Fradkin Aug. 1977 11 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 28, no. 1, 1975 p 113-118 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75139) Avail: NTIS HC A02/MF A01 CSCL 06P

A mathematical model based on heat balance equations was developed for studying temperature distribution in the human body under deep hyperthermia which is often induced in the treatment of malignant tumors. The model yields results which are in satisfactory agreement with experimental data. The distribution of temperature under various conditions of induced hyperthermia, i.e. as a function of water temperature and supply rate, is examined on the basis of temperature distribution curves in various body zones. Author

N78-11689*# National Aeronautics and Space Administration, Washington, D. C.
CIRCADIAN RHYTHMS IN AEROSPACE MEDICINE
Angel Salinas Aracil Oct. 1977 18 p refs Transl. into ENGLISH from Rev. Aeron. y Astronautica, v. 37, no. 435, Feb. 1977 p 109-118 Original language document was announced as A77-27000 Transl. by Sci. Transl. Serv. Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75165) Avail: NTIS HC A02/MF A01 CSCL 06P

The cyclical nature of bodily functions is reviewed, in particular those functions likely to affect pilot performance. Author

N78-11690*# National Aeronautics and Space Administration, Washington, D. C.
SUPRACHIASMATIC NUCLEI AND CIRCADIAN RHYTHMS. THE ROLE OF SUPRACHIASMATIC NUCLEI ON RHYTHMIC ACTIVITY OF NEURONS IN THE LATERAL HYPOTHALAMIC AREA, VENTROMEDIAN NUCLEI AND PINEAL GLAND
Hitoo Nishino Sep. 1977 29 p refs Transl. into ENGLISH from Folia Pharmacol. Japan., v. 72, no. 8, 1976 p 941-954 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Orignal doc. prep. by Wakayama Med. Coll. (Japan)
(Contract NASw-2790)
(NASA-TM-75155) Avail: NTIS HC A03/MF A01 CSCL 06P

Unit activity of lateral hypothalamic area (LHA) and Ventromedian nuclei (VMN) was recorded in urethane anesthetized male rats. A 5 to 10 sec. a 3-5 min and a circadian rhythmicity were observed. In about 15% of all neurons, spontaneous activity of LHA and VMN showed reciprocal relationships. Subthreshold stimuli applied at a slow rate in the septum and the suprachiasmatic nuclei (SCN) suppressed the rhythms without changing firing rates. On the other hand, stimulation of the optic nerve at a rate of 5 to 10/sec increased firing rates in 1/3 of neurons of SCN. Iontophoretically applied acetylcholine increased 80% of tested neurons of SCN, whereas norepinephrine, dopamine and 5 HT inhibited 64, 60 and 75% of SCN neurons respectively. These inhibitions were much stronger in neurons, the activity of which was increased by optic nerve stimulation. Stimulation of the SCN inhibited the tonic activity in cervical sympathetic nerves. Author

N78-11691*# Colorado State Univ., Fort Collins. Dept. of Physiology and Biophysics.
TRANSCUTANEOUS MEASUREMENT OF VOLUME BLOOD FLOW
R. E. Daigle, F. D. McLeod, C. W. Miller, M. B. Histand, and M. K. Wells 1 Aug. 1974 76 p refs
(NASA-CR-155233; Grant NsG-2009) Avail: NTIS HC A05/MF A01 CSCL 06P

Blood flow velocity measurements, using Doppler velocimeter, are described. The ability to measure blood velocity using ultrasound is derived from the Doppler effect; the change in frequency which occurs when sound is reflected or transmitted from a moving target. When ultrasound of the appropriate frequency is transmitted through a moving blood stream, the blood cells act as point scatterers of ultrasonic energy. If this scattered ultrasonic energy is detected, it is found to be shifted in frequency according to the velocity of the blood cells, nu, the frequency of the incident sound, f sub o, the speed of sound in the medium, c, and the angle between the sound beam and the velocity vector, o. The relation describing this effect is known as the Doppler equation. Delta f = 2 f sub o x nu x cos alpha/c. The theoretical and experimental methods are evaluated. Author

N78-11692*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INDOMETHACIN-ANTIHISTAMINE COMBINATION FOR GASTRIC ULCERATION CONTROL Patent Application
Patricia A. Brown (San Jose State Univ., Calif.) and Joan Vernikos-Danellis, inventors (to NASA) Filed 10 Nov. 1977 18 p
(NASA-Case-ARC-11118-1; US-Patent-Appl-SN-850504) Avail: NTIS HC A02/MF A01 CSCL 06E

An anti-inflammatory and analgesic composition is disclosed. The agent contains indomethacin and an H1 or an H2 histamine receptor antagonist in an amount sufficient to reduce gastric distress caused by indomethacin. Usable antagonists include pyrilamine, promethazine, metiamide and cimetidine. NASA

N78-11693# Naval Civil Engineering Lab., Port Hueneme, Calif.
A FINITE ELEMENT HEAD INJURY MODEL. VOLUME 2: COMPUTER PROGRAM DOCUMENTATION Final Report, Jun. 1973 - Jun. 1977
T. A. Shugar Jul. 1977 161 p refs
(RR0230301)
(AD-A043582; CEL-R-854-2-Vol-2) Avail: NTIS MF A01 CSCL 06/2

Volume II contains necessary information and documentation for executing the HIM computer program. Documentation includes a user's manual, a flow chart, CDC 6600 control cards, sample input data, and a FORTRAN IV source code listing of the HIM program. In addition, listings are provided for a preprocessor (skull mesh generator), a bandwidth minimizer, and a subroutine for an improved finite element for simulating the load-deformation response of the skull. Author (GRA)

N78-11694# Naval Civil Engineering Lab., Port Hueneme, Calif. Construction Battalion Center.
A FINITE ELEMENT HEAD INJURY MODEL. VOLUME 1: THEORY, DEVELOPMENT, AND RESULTS Final Report, Jun. 1973 - Jun. 1977
T. A. Shugar Jul. 1977 216 p refs Sponsored in party by DOT
(RR0230301)
(AD-A043605; CEL-TR-854-1) Avail: NTIS HC A10/MF A01 CSCL 06/2

The results of a head injury model development program are presented, including a description of the resulting model's features and its capabilities for simulating direct and indirect impact forces. The model's validity is discussed in terms of level of confidence and verification. Skull bone response and brain response are presented for a variety of dynamic simulations. Over 75 dynamic and static computer runs have been executed in its development. The basic features of the model are described, including recognizable skull geometry, linear elastic and linear visco-elastic behavior, and a capability for specifying arbitrary impact loads and boundary conditions. A special modification of the isoparametric element is shown to be particularly suited to simulation of the dynamic response of nearly incompressible brain matter. A preprocessor enables automatic mesh generation of a skull model consistent with a prescribed set of geometrical data supplied by the user. Either complete three-dimensional skulls or skulls symmetrical with respect to the midsagittal plane can be specified in the mesh generation process. GRA

N78-11695# Massachusetts Inst. of Tech., Cambridge. Dept. of Psychology.
EXPERIMENTS IN TEXTURE PERCEPTION Annual Report, 1 Jun. 1976 - 31 May 1977
Whitman A. Richards Jul. 1977 31 p refs
(Contract F44620-74-C-0076; ARPA Order 2765)
(AD-A043402; AFOSR-77-0910TR) Avail: NTIS HC A03/MF A01 CSCL 06/16

Over the past year, our special graphics display has been used to examine several properties of texture perception. The most important result is the finding that most uniform textures can be simulated or 'matched' by a very small number of variables, provided that these variables contain the basic elemental tokens of the display. The number of these matching variables may be as small as three, and usually four is sufficient to produce excellent 'texture metamers'. Both linear, or one-dimensional luminance distributions and two-dimensional texture patterns are being studied. Additional work has also been completed that examined the discriminibility of different n-gram statistics for random-check textures. However, this approach does not appear to be so fruitful a method for studying texture perception as the method of 'Generalized Colorimetry', which is outlined briefly in the first section of this report. Our work to date indicates that the human observer is quite poor at discriminating textures. Hence, a considerable saving in communicating texture information can be achieved through the use of texture metamers. Author (GRA)

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N78-11696*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INVESTIGATION OF RIDE QUALITY RATING SCALES
Thomas K. Dempsey, Glynn D. Coates (Old Dominion Univ.), and Jack D. Leatherwood Nov. 1977 48 p refs
(NASA-TP-1064) Avail: NTIS HC A03/MF A01 CSCL 05J

An experimental investigation was conducted for the combined purposes of determining the relative merits of various category scales for the prediction of human discomfort response to vibration and for determining the mathematical relationships whereby subjective data are transformed from one scale to other scales. There were 16 category scales analyzed representing various parametric combinations of polarity, that is, unipolar and bipolar, scale type, and number of scalar points. Results indicated that unipolar continuous-type scales containing either seven or nine scalar points provide the greatest reliability and discriminability. Transformations of subjective data between category scales were found to be feasible with unipolar scales of a larger number of scalar points providing the greatest accuracy of transformation. The results contain coefficients for transformation of subjective data between the category scales investigated. A result of particular interest was that the comfort half of a bipolar scale was seldom used by subjects to describe their subjective reaction to vibration. Author

N78-11697# New Mexico State Univ., University Park. Dept. of Psychology.
COLOR RESEARCH FOR VISUAL DISPLAYS Final Report
Warren H. Teichner and Richard E. Christ Jun. 1977 133 p refs
(Contract N00014-76-C-0306)
(AD-A043609; ONR-CR213-102-4F) Avail: NTIS HC A07/MF A01 CSCL 05/8

This report presents the results of three complex multiple task experiments intended to compare the effectiveness of color coding in visual displays against coding by achromatic letters, digits, and shapes. The results of these three experiments are then integrated with previously reported research to provide a comprehensive assessment of the potential advantages and disadvantages of color coding. Author (GRA)

N78-11698# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany). Abt. Luftfahrtpsychologie.
ACTIVITIES OF THE DEPARTMENT OF AVIATION PSYCHOLOGY CONCERNING THE CONSULTANCY CONTRACT WITH THE DEUTSCHE LUFTHANSA AG Annual Report, 1974 [JAHRESBERICHT 1974 DER ABT. LUFTFAHRTPSYCHOLOGIE ZUM BERATUNGSAUFTRAG DER DEUTSCHEN LUFTHANSA AG]
K. Steininger, S. Fichtbauer, K. M. Goeters, and H. Kirsch 1976 27 p refs In GERMAN
(DLR-IB-355-75/01) Avail: NTIS HC A03/MF A01

Results of psychological aptitude tests for cockpit personnel selection for the Deutsche Lufthansa are reported for the period January through December 1974. An overall survey of these tests covering the past 20 years is also given. ESA

N78-11699# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany). Abt. Luftfahrtpsychologie.
PSYCHOLOGICAL APTITUDE TEST OF AVIATION PERSONNEL FROM MALAWI [PSYCHOLOGISCHE EIGNUNGSPRUEFUNG VON LUFTFAHRTPERSONAL AUS MALAWI]
Klaus-Martin Goeters 1975 13 p refs In GERMAN
(DLR-IB-355-75/03) Avail: NTIS HC A02/MF A01

Results of a series of tests for selection of 8 flight crew personnel from 32 applicants are reported. The jobs to be filled were those of navigator and mechanic onboard a Dornier Skyservant aircraft. The test battery used consisted mainly of culture fair tests, not taking into account knowledge of language and previous education. ESA

N78-11700# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany). Abt. Luftfahrtpsychologie.
RELATION BETWEEN PULSE RATE DURING THE COMPLEX COORDINATION TEST AND SEVERAL PSYCHOLOGICAL MEASURES OF EFFORT AND STRESS [DER ZUSAMMENHANG ZWISCHEN DER PULSFREQUENZ WAEHREND DER PRUEFUNG MIT DEM COMPLEX COORDINATION TEST UND MEHREREN PSYCHOLOGISCHEN MASSEN DES LEISTUNGSEINSATZES UND DER BEANSPRUCHUNG]
Klaus-Martin Goeters 1975 8 p refs In GERMAN
(DLR-IB-355-75/04) Avail: NTIS HC A02/MF A01

The connection between physiological activation in a test situation and psychological measures of effort and stress was investigated for 33 applicants for flight navigator training. The object of this work is to replace psychological measures with strong subjective components by objective physiological parameters. Physiological activation was related to pulse rate. It was

found that no real correlation exists, and that pulse rate changes are always ambiguous. ESA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N78-11701*# National Aeronautics and Space Administration, Washington, D. C.
STUDIES OF PERCEPTION OF INFORMATION ON THE SPATIAL POSITION OF AN AIRCRAFT
M. Zebrowski Aug. 1977 10 p Transl. into ENGLISH from Tech. Lotnicza i Astronautyczna (Poland), v. 26, 1971 p 35-37, 39 Original language document was announced as A72-16180 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA Order RA-35372)
(NASA-TM-75153) Avail: NTIS HC A02/MF A01 CSCL 05E

Problems of pilot visual perception were identified, specifically problems of identifiying the surface of the earth at moment of transition from flight-instrument observation. The percepted difficulties studied were: (1) the accuracy of defining the slope of the flight path during lack of visibility of the actual line of the horizon, (2) the accuracy of predicting the time remaining before landing under conditions of limited external visibility, and (3) the structure of the shape of the earth's surface necessary for the maximum accurate determination of flight-path slope and prediction of time remaining to landing. Author

N78-11702*# National Aeronautics and Space Administration, Washington, D. C.
PROVISIONAL STANDARDS OF RADIATION SAFETY OF FLIGHT PERSONNEL AND PASSENGERS IN AIR TRANSPORT OF THE CIVIL AVIATION
Oct. 1977 20 p Transl. into ENGLISH from Vremennyye Normy Radiatsionnoy Bezopasnosti Letnogo Personala i Passazhirov Vozdushnogo Transporta Grazhdanskoy Aviatsil, USSR Ministry of Health (Moscow), report NBRBGA-75, 1975 p 1-17 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75052) Avail: NTIS HC A02/MF A01 CSCL 06K

Provisional standards for radiation affecting passenger aircraft are considered. Agencies responsible for seeing that the regulations are enforced are designated while radiation sources and types of radiation are defined. Standard levels of permissible radiation are given and conditions for radiation safety are discussed. Dosimetric equipment on board aircraft is delineated and regulation effective dates are given. Author

N78-11703# ILC Industries, Inc., Frederica, Del.
DEVELOPMENT OF A FIRE PROTECTIVE OVERGARMENT FOR USE BY AIR CARRIER FLIGHT ATTENDANTS Final Report, Jul. 1975 - Feb. 1977
John F. Rayfield Feb. 1977 99 p refs
(Contract DOT-FA75WA-3696)
(AD-A042329/3; FAA-RD-77-18) Avail: NTIS HC A05/MF A01 CSCL 06/17

A garment was developed to provide protection to flight attendants in proximity to cabin fires. Based on laboratory flames and heat flux tests, garment materials were chosen. A prototype garment was fabricated, including a breathing system and hood. The garment was tested for donning and mobility in an aircraft cabin, and was subjected to a simulated cabin fire exposure that approximated the contract design conditions. Author

N78-11704*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AUTOMATIC CONTROL OF HUMAN THERMAL COMFORT WITH A LIQUID-COOLED GARMENT
Lawrence H. Kuznetz Sep. 1977 42 p refs
(NASA-TM-58205; JSC-12955) Avail: NTIS HC A03/MF A01 CSCL 05H

Water cooling in a liquid-cooled garment is used to maintain the thermal comfort of crewmembers during extravehicular activity. The feasibility of a simple control that will operate automatically to maintain the thermal comfort is established. Data on three test subjects are included to support the conclusion that heat balance can be maintained well within allowable medical limits. The controller concept was also successfully demonstrated for ground-based applications and shows potential for any tasks involving the use of liquid-cooled garments. Author

N78-11705*# Transportation Systems Center, Cambridge, Mass.
SUMMARY REPORT: WORKSHOP ON VEHICLE RIDE QUALITY Final Report, 11-15 Aug. 1975
A. R. Kulthau, ed. (Virginia Univ.) and Anna W. Wichansky, ed. Jul. 1977 167 p refs Workshop held at Williamsburg, Va., 13-15 Aug. 1975
(Grant NGR-47-005-181)
(NASA-CP-2013; DOT-TSC-OST-77-44) Avail: NTIS HC A08/MF A01 CSCL 05H

Procedures are summarized to optimize urban transportation with emphasis on vehicle ride quality. For individual titles, see N78-11706 through N78-11711.

N78-11706*# Transportation Systems Center, Cambridge, Mass.
ACCOMPLISHMENTS IN RIDE QUALITY RESEARCH: PRESENT AND NEAR FUTURE
In its Summary Report: Workshop on Vehicle Ride Quality Jul. 1977 p 1-19 refs (For availability see N78-11705 02-54)
Avail: NTIS HC A08/MF A01 CSCL 05H

Areas of research in the field of ride quality were categorized into generic subdivisions. The following generic areas were identified: single degree of freedom simulations, multiple degrees of freedom simulations, field simulations, field experiments, surveys/reviews, and modeling techniques. From this review a consensus was reached on the projection of needs for future research efforts, including a prioritization, as well as time and cost estimates of ride quality studies. Author

N78-11707*# Transportation Systems Center, Cambridge, Mass.
NEEDS OF THE TRANSPORTATION COMMUNITY: PRESENT AND NEAR FUTURE
In its Summary Report: Workshop on Vehicle Ride Quality Jul. 1977 p 20-37 ref (For availability see N78-11705 02-54)
Avail: NTIS HC A08/MF A01 CSCL 05H

The impact on the passenger of all aspects of the carrier vehicle physical environment that affect his acceptance of the ride was studied. While motion and vibration are recognized as prime factors affecting subjective reactions, ride quality includes other factors as well (e.g., noise, roominess, etc.) which also can be important. Variables (both subjective and objective) involved and of the interacting effects between variables are identified. Author

N78-11708*# Transportation Systems Center, Cambridge, Mass.
RIDE QUALITY RESEARCH TECHNIQUES: SECTION ON GENERAL TECHNIQUES
In its Summary Report: Workshop on Vehicle Ride Quality Jul. 1977 p 38-64 refs (For availability see N78-11705 02-54)
Avail: NTIS HC A08/MF A01 CSCL 05H

Information is gathered about the methods currently used for the study of ride quality in a variety of transportation modes by a variety of research organizations, including universities, Federal agencies, contracting firms, and private industries. Detailed descriptions of these techniques and their strengths and weaknesses, and identifying the organizations using such methods are presented. The specific efforts of the Group's participants, as well as a variety of feasible approaches not currently in use, are presented as methodological alternatives under the three basic factors which must be considered in ride quality studies: research techniques, research environments, and choice of subjects. Author

N78-11709*# Transportation Systems Center, Cambridge, Mass.
RIDE QUALITY RESEARCH TECHNIQUES: SECTION ON SCALING TECHNIQUES
In its Summary Report: Workshop on Vehicle Ride Quality Jul. 1977 p 65-72 refs (For availability see N78-11705 02-54)
Avail: NTIS HC A08/MF A01 CSCL 05H

Scaling techniques appropriate for the measurement of ride

quality subjective responses are evaluated. The major focal points of interest are summarized in succeeding paragraphs as follow: (1) scope of scaling, (2) goal of scaling, (3) category scales; including polarity, scalar points, and whether the scale is discrete or continuous in nature, (4) need and use of adjectives and/or adverbs, (5) role and use of magnitude estimation, (6) multiple response measures; and (7) related topics. Author

N78-11710*# Transportation Systems Center, Cambridge, Mass.
RIDE CONTROL TECHNIQUES
In its Summary Report: Workshop on Vehicle Ride Quality Jul. 1977 p 73-143 refs (For availability see N78-11705 02-54)
Avail: NTIS HC A08/MF A01 CSCL 05H

The state-of-the-art in ride quality control techniques for all the primary modes of transportation and the needs for the future are summarized. Author

N78-11711*# Transportation Systems Center, Cambridge, Mass.
ON SCALING TECHNIQUES
In its Summary Report: Workshop on Vehicle Ride Quality Jul. 1977 p 144-156 refs (For availability see N78-11705 02-54)
Avail: NTIS HC A08/MF A01 CSCL 05H

An introductory review of the principles of scaling with emphasis on ride quality work is presented. It will be divided into six parts as follows: (1) definition of scaling, (2) scope and goals of scaling, (3) scaling techniques (with emphasis on rating scale, magnitude estimation procedures and cross-modality matching), (4) laboratory vs. field studies, (5) multivariate analysis; and (6) selected references. Author

N78-11712*# Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.
ANALYTICAL EVALUATION OF TWO MOTION WASHOUT TECHNIQUES Final Report, 1 May - 31 Oct. 1977
Lawrence R. Young Oct. 1977 160 p refs
(Grant NsG-1416)
(NASA-CR-154582) Avail: NTIS HC A08/MF A01 CSCL 05E

Practical tools were developed which extend the state of the art of moving base flight simulation for research and training purposes. The use of visual and vestibular cues to minimize the actual motion of the simulator itself was a primary consideration. The investigation consisted of optimum programming of motion cues based on a physiological model of the vestibular system to yield 'ideal washout logic' for any given simulator constraints. Author

N78-11713*# Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.
A COMPARISON OF WASHOUT FILTERS USING A HUMAN DYNAMIC ORIENTATION MODEL M.S. Thesis
Susan A. Riedel Sep. 1977 146 p refs
(Grant NsG-1416)
(NASA-CR-154581) Avail: NTIS HC A07/MF A01 CSCL 05E

The Ormsby model of human dynamic orientation, a discrete time computer program, was used to provide a vestibular explanation for observed differences between two washout schemes. These washout schemes, a linear washout and a nonlinear washout, were subjectively evaluated. It was found that the linear washout presented false rate cues, causing pilots to rate the simulation fidelity of the linear scheme much lower than the nonlinear scheme. By inputting these motion histories into the Ormsby model, it was shown that the linear filter causes discontinuities in the pilot's perceived angular velocity, resulting in the sensation of an anomalous rate cue. This phenomenon does not occur with the use of the nonlinear filter. Author

N78-11714# Boeing Commercial Airplane Co., Seattle, Wash. ATC/Electronics Technology-Crew Systems.
AIRCRAFT ALERTING SYSTEMS CRITERIA STUDY. VOLUME 2: HUMAN FACTORS GUIDELINES FOR AIRCRAFT ALERTING SYSTEMS Final Report, Jan. - Nov. 1976
G. P. Boucek, Jr. May 1977 139 p refs
(Contract DOT-FA73WA-3233)
(AD-A043383/9; FAA-RD-76-222-2-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 01/4

Human factors literature that describes pilot response characteristics when confronted with aircraft warning, caution, and advisory signals was reviewed. The review covered visual, aural (sounds and voice), tactile, and bimodal alerts. Data obtained therefrom were categorized into: (1) non-aircraft-related test results, (2) aircraft-related test results, and (3) military standards/design guidelines so as to establish the applicability of the data and to identify technical areas in which more human factors data relevant to aircraft-alerting systems may be required. Summaries of the literature for (1) factors that affect signal detection, and (2) factors that affect time from detection to response are provided. The results of the review were used to establish preliminary design guidelines for alerting systems in future commerical transport aircraft. Author

N78-11715# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
ACCELERATION EFFECTS ON THE ABILITY TO ACTIVATE EMERGENCY DEVICES IN F-4 AIRCRAFT Final Report
Emma Fessenden 11 Jul. 1977 83 p refs
(AD-A042281; NADC-77105-40) Avail: NTIS HC A05/MF A01 CSCL 01/3

Experiments have been performed and are described in this report which measure the influence of environment on the time it takes to reach an emergency control activation device and which measure the change of physical position at the time of activation due to the environmental forces. Data are reported for both loose and tight torso harness straps. Minus Gx and minus Gz are identified as the components of various likely emergency environments which cause pilots the greatest difficulties. The contribution of combined individual anthropometric measures has been identified as having very pronounced influence on the reachability of certain control devices under specific environments. Improvements in existing seat harness systems and testing for future systems to be developed are recommended. Author (GRA)

N78-11716# Defense Systems Management School, Fort Belvoir, Va.
HUMAN FACTORS ENGINEERING IN AIR FORCE WEAPON SYSTEMS ACQUISITION
Bronislaw P. Prokuski, Jr. 1977 41 p refs
(AD-A043207) Avail: NTIS HC A03/MF A01 CSCL 05/5

This report examines the role that human factors engineering plays in Air Force systems acquisition. It focused upon the conceptual, validation and full-scale engineering development phases of the acquisition process since it is during these phases that the major benefits of human factors engineering can be derived. Based upon previous analyses, letter reports, and the author's personal experience, human factors engineering activities appropriate to these phases are discussed. A brief review of Department of Defense and Air Force systems acquisition policy pertaining to human factors engineering is also presented. Some applications to present weapon programs are identified and discussed. It was concluded that the success of human factors engineering efforts is directly related to the management emphasis and priority given to consideration of the man-machine interface. Recommendations include strengthening the human factors engineering focal point and improvement of the human factors engineering career field to provide the necessary emphasis and resources for human factors engineering implementation. Author (GRA)

N78-11717# Kentucky Univ. Research Foundation, Lexington.
THE DEVELOPMENT, MAINTENANCE, AND MATHEMATICAL DESCRIPTION OF TRACKING BEHAVIOR IN MAN AND THE RHESUS MONKEY
D. F. McCoy and P. K. Bhagat Jun. 1977 67 p refs
(Grant AF-AFOSR-2751-75)
(AD-A043225; AFOSR-77-0966TR) Avail: NTIS HC A04/MF A01 CSCL 05/8

Procedures are described wherein Rhesus monkeys are trained on pursuit and compensatory tracking tasks. Parameters of these procedures are explored. Mathematical analysis of these methods is also reported. Author (GRA)

N78-11718# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
STATE-OF-THE-ART IN ADAPTABLE-PROGRAMMABLE ASSEMBLY SYSTEMS
R. G. Abraham 31 May 1977 165 p refs
(Grant NSF ISP-76-24164)
(PB-270054/0; Rept-77-1G6-APAAS-R3; NSF/RA-770140) Avail: NTIS HC A08/MF A01 CSCL 06D

The state-of-the-art in the technologies related to adaptable-programmable automatic assembly is surveyed. Technology areas surveyed included manipulator arms, end effectors, force/tactile sensing, vision systems, computer hardware and software systems, and parts presentation and fixturing equipment. These areas are surveyed from the aspect of how well does the available technology, or technology that will be available in the near term, meet the requirements of applications in automated assembly in a batch manufacturing environment. It is concluded that, although there are some voids, a technology-base does exist which can be applied with suitable development in specified areas of an adaptable programmable assembly system. GRA

N78-11719# Army Natick Research and Development Command, Mass. Clothing Equipment and Materials Engineering Lab.
THE EFFECTS OF LAYERS OF COLD WEATHER CLOTHING AND TYPE OF LINER ON THE PSYCHOMOTOR PERFORMANCE OF MEN
John M. Lockhart and Carolyn K. Bensel Jun. 1977 117 p refs
(AD-A043835; CE/MEL-171; NATICK-TR-77/018) Avail: NTIS HC A06/MF A01 CSCL 06/17

This study was conducted to determine the differential effects on men's motor performance of wearing the clothing layers comprising the Army cold weather system, including both nylon polyester (Std. A) and mohair frieze (Std. B) liners. The dependent variables investigated were body flexibility, rate of movement, psychomotor coordination, manual dexterity, and effort exerted for task performance. Sixteen Army enlisted men, outfitted in winter underwear, performed the battery of 14 tasks under each of the following conditions: (1) wool shirt and trousers, (2) plus field jacket and trousers, (3) plus Std. A liners or Std. B liners in the field layer, (4) plus parka and arctic trousers, (5) plus Std. A or Std. B liners in the arctic layer. In general, Std. B liners impaired certain aspects of psychomotor performance, particularly body flexibility, to a greater extent than the Std. A liners did. In addition, the Std. A liners were rated more favorably by the users and resulted in a somewhat lower level of physical exertion, as represented by heart rate, than did the Std. B liners. Psychomotor performance level and user acceptance also decreased as the number of clothing layers was increased, but the layers were not equally deleterious in their effects on performance nor were all aspects of performance equally impaired by wearing a certain combination of layers. Interference with specific flexibility movements was attributed to such design characteristics as clothing weight, bulk, garment waist lengths, and garment waist dimensions. Author (GRA)

N78-11720# Army Command and General Staff Coll., Fort Leavenworth, Kansas.
A HUMAN FACTORS TAXONOMY Final Report M.S. Thesis
Noel J. Christman 10 Jun. 1977 69 p refs
(AD-A043723) Avail: NTIS HC A04/MF A01 CSCL 05/5

This paper surveys the topic of human factors in the form of a taxonomy. The taxonomy, a classification system based on the theory underlying the subject, is a valuable tool for surveying human factors. This taxonomy divided human factors into individual, small group, and large group categories as primary divisions. The sub-levels of each address information input, processing, and the attitudinal reactions which result. GRA

N78-11721# National Highway Traffic Safety Administration, Washington, D. C.
SEAT BELT PERFORMANCE IN 30 M.P.H. BARRIER IMPACTS
John B. Morris 27 Apr. 1977 66 p refs
(PB-269962/7; DOT-HS-802-480) Avail: NTIS HC A04/MF A01 CSCL 13F

Data relating to the seat belt performance of nine model year 1976 automobiles when subjected to the FMVSS No. 301 compliance test were obtained. A summary of the test data is presented and the test results are discussed. A relationship appears to exist between upper torso belt force and ride-down benefit. In those vehicles that exhibit a short crash duration and whose belt systems produce excessive slack time, upper shoulder belt forces are severe. GRA

N78-11722# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany). Abt. Luftfahrtpsychologie.
HUMAN FACTORS IN FLIGHT SAFETY [DER FAKTOR MENSCH IN DER FLUGSICHERHEIT]
K. Steininger 1975 22 p refs In GERMAN Sponsored by Bundesmin. fuer Forsch. u. Technol.
(DLR-IB-355-75/02) Avail: NTIS HC A02/MF A01

A model was developed for the causal layers of human error sources, and possible methodical measures for reducing error sources are discussed. These refer to the domains of personnel selection, training, man machine relation, and interpersonal communication and interaction. ESA

N78-11723# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany). Abt. Luftfahrtpsychologie.
MOBILE SMALL SIMULATOR FOR TRACKING AND MULTITASKING TESTS [EIN MOBILER KLEINSIMULATOR FUER TRACKING- UND MEHRFACHARBEITSVERSUCHE]
S. Fichtbauer 1975 16 p refs In GERMAN
(DLR-IB-355-75/06) Avail: NTIS HC A02/MF A01

The design and construction are described for a mobile small simulator for application in the investigation of control and reaction behavior of the human operator in man machine systems. The simulator is suitable for measurement of tracking and reaction performance as indicators of stress and fatigue in experimental psychophysiological tests, as well as testing of sensorimotor coordination capacity, attentiveness control, and the performance capacity for multiple tasking in aptitude tests for pilots. ESA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N78-11724*# National Aeronautics and Space Administration, Washington, D. C.
PROBLEMATICS OF DIFFERENT TECHNICAL MAINTENANCE FOR COMPUTERS
Z. Dostalek Aug. 1977 8 p Transl. into ENGLISH from Mechanizace a Automatizace Administrativy (Czechoslovakia),

v. 15, no. 12, 1975 p 511-512 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Orginial doc. prep. by VS UTAR (Czechoslovakia)
(NASA Order RA-35372-B)
(NASA-TM-75123) Avail: NTIS HC A02/MF A01 CSCL 09B

Two modes of operations are used in the technical maintenance of computers: servicing provided by the equipment supplier, and that done by specially trained computer users. The advantages and disadvantages of both modes are discussed. Maintenance downtime is tabulated for two computers serviced by user employees over an eight year period. A.R.H.

N78-11725# Eidgenoessische Technische Hochschule, Zurich (Switzerland).

STUDIES OF THE EFFECTS OF LINEAR SIGNAL DISTORTIONS ON DATA TRANSMISSION SYSTEMS UTILIZING BINARY FREQUENCY SHIFT KEYING Ph.D. Thesis [UNTERSUCHUNG DES EINFLUSSES LINEARER LEITUNGSUERZERRUNGEN AUF DATENUEBURTRAGUNGSSYSTEME MIT BINAERER FREQUENZUMTASTUNG]

Juergen Kemper 1977 124 p refs In GERMAN; ENGLISH summary
(ETH-5838) Avail: NTIS HC A06/MF A01

The influence of linear signal distortions on the overall system performance of data transmission systems utilizing binary frequency shift keying for medium speed data transmission up to about 1800 bps over switched telephone channels was evaluated to determine the effects of the channel properties on the quality of transmission and disadvantages and restrictions concerning the performance and working terms of data modems. System models corresponding to the practical system under consideration are introduced and the relationship between the error probability and the signal characteristics is derived. The result is applied to the outcome of system computer simulations to determine those signal parameters which strongly contribute to the decay of system performance. This simulation includes signal distortions caused by typical linear channel transfer characteristics. Methods for the measurement of this relation are proposed which enable testing the suitability of channels for data transmission. Fast response is obtained allowing for monitoring operating systems. Author

N78-11726# Naval Postgraduate School, Monterey, Calif.

AN ADAPTATION OF THE HERSHEY DIGITIZED CHARACTER SET FOR USE IN COMPUTER GRAPHICS AND TYPESETTING M.S. Thesis

Patrick Michael Doyle Jun. 1977 171 p refs
(AD-A042291) Avail: NTIS HC A08/MF A01 CSCL 09/2

Font definitions of 1377 characters of various styles developed by Allen V. Hershey were used as an initial data base. His character definitions were first put into a form suitable for use by vector graphics display processors, and then these vectors were converted into dot matrix form in a variety of point sizes. This conversion and digitization process was done using the C programming language; the host computer was a PDP-11/50 with the UNIX operating system, and the computerized typesetting was done on a VERSATEC 1200-A printer/plotter. As a result, a large data base for use in computerized typesetting has been developed. In addition, the computerized typesetting system at the Naval Postgraduate School has been improved and adapted to make use of the large number of fonts now available.
Author (GRA)

N78-11727# Air Force Human Resources Lab., Brooks AFB, Tex.

COMPUTER GRAPHICS: TWO AND THREE-DIMENSIONAL CLIPPING Interim Report

Michael L. Cyrus and Jay Beck May 1977 19 p
(AD-A043017; AFHRL-TR-77-14) Avail: NTIS HC A02/MF A01 CSCL 09/2

A clipping algorithm is derived and both two- and three-dimensional implementations of it are discussed. The algorithm finds the proper intersection of a line with any convex planar, polygon or spacial polyhedron. By interpretation of the computed clipping coefficients, both interior and exterior clipping to a convex region can result. Finally, the implementation lends itself well to highly parallel execution which reduces execution time.
Author (GRA)

N78-11728# Ballistic Research Labs., Aberdeen Proving Ground, Md.

A SIMPLE COMPUTER-DRIVEN ANALOG-TO-DIGITAL CONVERTER FOR USE WITH AN 8-BIT MICROCOMPUTER

Louis M. Colonna-Romano Aug. 1977 11 p refs
(DA Proj. 1T1-6101-A-91A)
(AD-A043658; BRL-MR-2780) Avail: NTIS HC A02/MF A01 CSCL 09/2

A very simple and inexpensive computer-driven analog-to-digital converter is described for use with an 8-bit microcomputer. Characteristics of the device are discussed along with possible improvements. A computer program written for an 8080A microprocessor to drive the device is given. Author (GRA)

N78-11729# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.

AN ALGORITHM FOR MINIMIZING PROGRAMMABLE LOGIC ARRAY REALIZATIONS M.S. Thesis

Alphonso Gar-Yau Soong Apr. 1977 98 p refs
(Contract DAAB07-72-C-0259; Grant NSF MCS-72-03488)
(AD-A043361; R-766; UILU-ENG-77-2213) Avail: NTIS HC A05/MF A01 CSCL 09/2

Due to the increasing use PLAs (Programmable Logic Arrays) in logic design, and efficient algorithm which performs multiple-output AND-OR logic minimization is desired. Quine-McCluskey (QM) logic minimization has been known for some time. A new AND-OR minimization algorithm for logic problems with up to 16 inputs and 8 outputs (standard limitations of PLAs available at present) is needed. The algorithm should be particularly effective for problems which require no more than 40 to 50 product terms in an optimum realization. In this report, such an algorithm is formulated which strives to achieve an AND-OR realization with the smallest number of AND gates. GRA

N78-11730# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

AN INSTRUCTABLE PRODUCTION SYSTEM: BASIC DESIGN ISSUES

Michael D. Rychener and Allen Newell May 1977 34 p refs Presented at Workshop on Pattern-Directed Inference Systems, Honolulu, Hawaii, 23-27 May 1977
(Contract F44620-73-C-0074)
(AD-A043492; AFOSR-77-1144TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

The full advantages of the incremental properties of production systems have yet to be exploited on a large scale. A promising vehicle for this is the task of instructing a system to solve problems in a complex domain. For this, it is important to express the instruction in a language similar to natural language and without detailed knowledge of the inner structure of the system. Instruction and close interaction with the system as it behaves are preferred over a longer feedback loop with more independent learning by the system. The domain is initially an abstract job shop. The beginning system has capabilities for solving problems, processing language building productions, and interacting with the task environment. All parts of the system are subject to instruction. The main problem-solving strategy, which permeates all four system components, is based on means-ends analysis and goal-subgoal search. This is coupled with an explicit representation of control knowledge. The system's behavior so far is restricted to simple environmental manipulations, a number of which must be taught before more complex tasks can be done. Author (GRA)

N78-11731# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

CONTROL REQUIREMENTS FOR THE DESIGN OF PRODUCTION SYSTEM ARCHITECTURES

Michael D. Rychener Jul. 1977 19 p refs
(Contract F44620-73-C-0074)
(AD-A043491; AFOSR-77-1145TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

Programs in the artificial intelligence domain impose unusual requirements on control structures. Production systems are a control structure with promising attributes for building generally intelligent systems with large knowledge bases. This paper presents examples to illustrate the unusual position taken by

production systems on a number of control and pattern-matching issues. Examples are chosen to illustrate certain powerful features and to provide critical tests which might be used to evaluate the effectiveness of new designs. Author (GRA)

N78-11732# California Univ., Livermore. Lawrence Livermore Lab.
STRUCTURED COMPUTER-AIDED DIGITAL LOGIC DESIGN, THE S-1 DESIGN SYSTEM
L. C. Widdoes, Jr. and T. M. McWilliams 31 Mar. 1977 14 p
(Contract W-7405-eng-48)
(UCID-17433) Avail: NTIS HC A02/MF A01

It is noted that such a system has resulted in a very large reduction in the amount of designer effort required to complete the design of a large-scale digital processing system in the first exercise of its capabilities. This basic and generally applicable advanced in digital design technology may be expected to affect quite favorably all complex digital systems developments. ERA

N78-11733# Stanford Linear Accelerator Center, Calif.
FILE MIGRATION Ph.D. Thesis
E. P. Stritter Jan. 1977 114 p
(Contract EY-76-C-03-0515)
(SLAC-200; STAN-CS-77-594) Avail: NTIS HC A06/MF A01

Automatic migration strategies were studied. A migration strategy was sought which maximized the probability that a file that is accessed will be found in secondary memory and which minimized the migration activity. Trace data of file system activity on a general purpose computer system collected for one year provided the basis for a quantitative study of migration. Various possible migration strategies are presented. Non-equivalent criteria were used for evaluating strategies. The LRU (least recently used) and MIN (the theoretically optimum strategy for fixed sized pages) were studied. Other strategies, including LFU (least frequently used), that were suggested by the results of statistical analysis were examined. Replacement strategies are shown to be improved when the size of a file is taken into consideration. Some non-realizable strategies using knowledge of files' future accesses are presented. A simulation model of file system activity is examined. ERA

N78-11153*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Data Systems Section.
GCF CENTRAL PERFORMANCE MONITOR: FUNCTIONAL DESCRIPTION
N. C. S. Lau *In its* The Deep Space Network 15 Oct. 1977 p 206-208 (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N78-11734 North Carolina Univ., Chapel Hill.
DIVIDE AND CONQUER ALGORITHMS FOR CLOSEST POINT PROBLEMS IN MULTIDIMENSIONAL SPACE Ph.D. Thesis
Jon Louis Bentley 1976 107 p
Avail: Univ. Microfilms Order No. 77-17405

Contributions to multidimensional algorithms were twofold: basic results and basic methods. The results dealt with algorithms for determining properties of sets of N points in k dimensional space. Among other results it was shown that the closest pair among the N points could be found in time proportional to N log N and that the nearest neighbor to each point among the N could be found in time proportional to N(log N)k-1 to (for k > or = 2). The basic methods included an algorithm schema applicable to many multidimensional problems and fundamental concepts for dealing with such problems. The algorithms demonstrated the power of the divide and conquer strategy. The strategy was shown to be applicable to multidimensional problems. The basic technique was modified in many interesting ways to create faster algorithms. Dissert. Abstr.

N78-11735 Maryland Univ., College Park.
SEMANTIC CLASSIFICATION OF FEATURES OF PROGRAMMING LANGUAGES Ph.D. Thesis
Arthur Bruce Carmichael 1976 174 p
Avail: Univ. Microfilms Order No. 77-16359

Meaningful comparison of various programming language features based upon their semantics was made. A formalism was developed for the definition of languages as abstract sets of relations called operators defined over domains that consist of data types. Operators were then realized on a particular fixed machine using a fixed coding for the various data types. The complexity of a realization was measured quantitatively by a cost function based on the number of state transitions produced by the realization. The complexity of an operator was determined by the theoretical lower limit of complexity over all realizations of the operator. Results indicated that operational semantic classification of many features of programming languages is both theoretically and practically a reasonable technique.
Dissert. Abstr.

N78-11736 Purdue Univ., Lafayette, Ind.
A STUDY OF PROGRAM AND MEMORY POLICY BEHAVIOR Ph.D. Thesis
Gordon Scott Graham 1976 354 p
Avail: Univ. Microfilms Order No. 77-15411

Program behavior was studied in the light of the phase/transition model. Memory policies were classified into fixed partition and three variable partition policies. The working set policies perform the best because they correlate memory allocation with program behavior and have automatic control. The irremovable memory overshoot of nonlookahead policies was estimated relative to the optimal variable partition policy, and the page fault frequency policy was found to be more difficult to control than the Denning working set. Empirically derived semi-Markov models were found to be useless as locality macromodels because there is insufficient information to permit a synthetic generator to track the program's locality set. A proper locality model would be obtained by separating the program reference string into phases and transitions, obtaining separate parameters for a phase model and a transition model, and then recomposing behavior during synthetic generation. Dissert. Abstr.

N78-11737# Navy Experimental Diving Unit, Panama City, Fla.
ANALYSIS OF MULTIVARIATE DATA: A COMPUTER PROGRAM Final Report
Robert C. Carter, Jr. 25 Mar. 1977 21 p refs
(AD-A043180; NEDU-2-77) Avail: NTIS HC A02/MF A01 CSCL 09/2

A computer program is presented which calculates multivariate analyses of variance. The method used in the program is described, and an application of the program is illustrated. The method is appropriate when several variables are measured in each of several samples, and it is hypothesized that the average of each variable is the same in all samples. Author (GRA)

N78-11738# Naval Ship Research and Development Center, Bethesda, Md. Computation, Mathematics and Logistics Dept.
COMPUTER CENTER REFERENCE MANUAL Final Report
Sharon E. Good and David V. Sommer Jun. 1977 281 p refs Revision of CMD-24-75
(AD-A043559; CMLD-77-11-Rev-0; CMD-24-75) Avail: NTIS HC A13/MF A01 CSCL 09/2

The Computer Center Reference Manual provides an introduction to the CDC 6000 NOS/BE operating system for applications programmers. Some information has been distilled from many individual documents and augmented to reflect usage at DTNSRDC. Control card examples and descriptions of hardware and software are included. Author (GRA)

N78-11739# California Univ., Berkeley. Operations Research Center.
ALMOST RAY-HOMOTHETIC PRODUCTION CORRESPONDENCES
Rokaya Al-Ayat and Rolf Fare May 1977 21 p refs
(Contract N00014-76-C-0134; NR Proj. 047-033)
(AD-A043561; ORC-77-15) Avail: NTIS HC A02/MF A01 CSCL 09/2

A class of production correspondences for which nonproportional scaling of inputs (outputs) result in fixed scaling of outputs (inputs) is introduced. Such correspondences termed, almost ray-homothetic contain the ray-homothetic structure as a special case. Although more general this scaling law maintains the linearity of expansion paths, and under special conditions on the input (output) set it is shown that linear expansion under nonlinear change of inputs (outputs) imply almost ray-homothetic output (input) structure. Author (GRA)

N78-11740# Michigan Univ., Ann Arbor. Systems Engineering Lab.

COLORED PETRI NETS: THEIR PROPERTIES AND APPLICATIONS Interim Report, 1 Oct. 1975 - 1 Jan. 1977

Cristian Radu Zervos and Keki B. Irani Griffiss AFB, N. Y. RADC Aug. 1977 331 p refs

(Contract F30602-76-C-0029)

(AD-A043564; RADC-tr-77-246) Avail: NTIS HC A15/MF A01 CSCL 09/2

The problem of representing reentrancy, recursivity and pipe-lining of control in asynchronous structures is examined with the intention of eliminating some of the drawbacks of the other solutions to their problems known so far. A model of concurrent systems having the capability of handling colored representations of control flow has been defined as an extension of an already existing model of parallel systems, the Petri Net Model. The structure and execution rules of Petri Nets have been modified in order to handle the colored tokens. Author (GRA)

N78-11741# Wisconsin Univ., Madison. Mathematics Research Center.

SOME NEW AND EFFICIENT ALGORITHMS FOR PORTFOLIO ANALYSIS Technical Summary Report

Jong-Shi Pang Mar. 1977 48 p refs

(Contract DAAG29-75-C-0024; Grant NSF MCS-75-17385)

(AD-A043412; MRC-TSR-1738) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper first describes a modified version of the parametric principal pivoting algorithm for the class of parametric linear complementarity problems with P-matrices. The modified version of the parametric principal pivoting algorithm is then used to develop a new and efficient algorithm to solve the class of portfolio analysis problems with positive definite (or equivalently, nonsingular) covariance matrices. Extension of the new algorithm to handle explicit upper-bounds is also established. The new algorithm and its extension are then specialized to the index models. In these specializations, the algorithms are particularly effective, achieving dramatic savings in both storage and computations. Author (GRA)

N78-11742# PRC Information Sciences Co., McLean, Va.

PRELIMINARY FUNCTIONAL DESIGN FOR THE EVENTS DIAGNOSTICS SYSTEM Final Technical Report, 13 May 1976 - 13 Feb. 1977

Timothy J. Delanty, Hawley A. Blanchard, Pauline M. Ippolito, Steven A. Soechtig, and Jack E. Pevenstein Griffiss AFB, N. Y. RADC Jul. 1977 90 p

(Contract F30602-76-C-0267)

(AD-A043459; PRC-R-2014; RADC-TR-77-235) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report describes the preliminary functional design for The Events Diagnostics System (TEDS). TEDS has evolved from a series of studies begun in 1972 focused on computer assisted ways by which an Indications and Warning (I and W) analyst may be helped to draw inferences concerning the likelihood occurrences of noteworthy and significant military-political events. TEDS features an event classification structure consisting of 26 military, political, diplomatic and economic event classes. Each event class consists of a number of 'a priori' indicators as selected from official literature, historical analysis and expert testimony. When these indicators are matched with an 'a posteriori' incident report, TEDS performs its processing functions and generates the several diagnostic displays for use by the analyst. Periodic multiple regression analyses are performed with the aid of the analyst and after-the-fact event evaluation to adjust the model by specific indicator and event class, thus providing for systematic feedback and improvement. GRA

N78-11743# Pattern Analysis and Recognition Corp., Rome, N. Y.

EVALUATION OF RELATIONAL INTELLIGENCE ANALYSIS SYSTEM Final Technical Report

Clinton P. Mah Griffiss AFB, N. Y. RADC Jul. 1977 45 p refs

(Contract F30602-75-C-0241)

(AD-A043488; PAR-77-7; RADC-TR-77-255) Avail: NTIS HC A03/MF A01 CSCL 09/2

The Rapidly Extensible Language (REL) system under evaluation here allows a user to define a natural computer programming language by extending an English-like base language through dynamic definitional facilities. The scheme seems especially promising for science and technology intelligence data analysis at FTD because of a need to let analysts with relatively little computer experience work interactively with on-line data through a conversational system. The present study finds that REL meets this need partially; where it tends to fall short, recommendations are made for future development of possible remedies. Author (GRA)

N78-11744# DBA Systems, Inc., Melbourne, Fla.

OFF-LINE ORTHOPRINTER SOFTWARE Final Technical Report

Jerry Maupin and Scott Webster Griffiss AFB, N. Y. RADC Aug. 1977 148 p refs

(Contract F30602-74-C-0297)

(AD-A043456; RADC-TR-77-256) Avail: NTIS HC A07/MF A01 CSCL 09/2

This effort developed experimental software to expand the digital terrain data input options to the Off-Line Orthophoto Printer (OOP). The additional sources addressed were random terrain relief points, digitized contour data and multiple AS-11B-1 stereoplotter profile data sets. Profile sets compiled from earlier coverage can now be used with more current imagery. The major task was to develop algorithms which could generate profiles compatible with the OOP operating software from the various terrain data sets. Profiles were generated using terrain modeling as well as interpolation schemes. Terrain modeling investigations used polynomial and multiquadratic functions. The multiquadratic function appeared to work with evenly spaced input such as AS-11B-1 profile data while the interpolation scheme was the best choice for digitized contour data. The other major task was to transform the image orientation data and the digital terrain data into a common coordinate system compatible with the OOP operating system. The report covers the mathematics, subroutine descriptions, and test results. Author (GRA)

N78-11745# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

SEMANTIC GRAMMAR: A TECHNIQUE FOR CONSTRUCTING NATURAL LANGUAGE INTERFACES TO INSTRUCTIONAL SYSTEMS

Richard R. Burton and John Seely Brown May 1977 115 p refs

(Contract MDA903-76-C-0108)

(AD-A043503; BBN-3587; ICAI-5) Avail: NTIS HC A06/MF A01 CSCL 09/2

One of the major stumbling blocks to the more effective educational use of computers is the lack of a natural means of communication between the student and the computer. This report addresses the problems of developing a system that can understand natural language (English) for advanced computer-based instructional systems. Training environments impose the following requirements on a natural language understanding system: (1) efficiency, (2) habitability, (3) self-teachability, and (4) awareness of ambiguity. The notion of semantic grammar is introduced as a paradigm for organizing the knowledge required to understand language which permits efficient parsing. In semantic grammar, non-terminal categories are formed on conceptual rather than syntactic bases. This allows semantic knowledge to be integrated into the parsing process whenever it is beneficial. The semantic grammar also lends itself to a simple yet powerful method of handling pronominalizations, ellipses and other sentence fragments that arise naturally in a dialogue situation. GRA

N78-11746# Mons Univ. (Belgium). Dept. d'Astrophysique.
IMPROVEMENTS TO THE BASIC SOFTWARE FOR A BENSON PLOTTER [QUELQUES AMELIORATIONS AU LOGICIEL DE BASE POUR TABLE TRACANTE BENSON]
J. Lion 1977 23 p ref In FRENCH
(Commun-62) Avail: NTIS HC A02/MF A01

A set of subroutines is presented. To minimize the loss of paper, the new software requires that plotting be performed within predetermined areas that are automatically placed one above the other. Scaling factors can be applied, user defined writing characters may be introduced, and messages can be inserted on the drawing. The software also produces error messages regarding both software bugs and unexpected problems arising during execution of a plot. ESA

N78-11134*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. TDA Engineering Section.
THE DSN PROGRAMMING SYSTEM
W. D. Hodgson *In its* The Deep Space Network 15 Oct. 1977 p 4-9 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

N78-11144*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
ANTENNA POINTING SUBSYSTEM DRIVE TAPE GENERATOR: ANOTHER NEW INTERFACE
R. F. Emerson *In its* The Deep Space Network 15 Oct. 1977 p 101-102 (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

N78-11145*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Data Systems Section.
AN MBASIC USER PROFILE
R. L. Schwartz *In its* The Deep Space Network 15 Oct. 1977 p 103-111 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

N78-11146*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Data Systems Section.
CRISPFLOW, A STRUCTURED PROGRAM DESIGN FLOWCHART
R. C. Tausworthe and K. C. Landon *In its* The Deep Space Network 15 Oct. 1977 p 112-126 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

N78-11151*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystem Section.
MICROCOMPUTER CENTRAL PROCESSING UNIT MODULE
O. B. Parham *In its* The Deep Space Network 15 Oct. 1977 p 172-175 refs (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

N78-11152*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. TDA Engineering Office.
FAST ALGORITHMS FOR COMPUTING MERSENNE-PRIME NUMBER-THEORETIC TRANSFORMS
I. S. Reed (Southern Calif. Univ.) and T. K. Truong *In its* The Deep Space Network 15 Oct. 1977 p 176-205 refs (For availability see N78-11132 02-12)
(Grant AF-AFOSR-2798-75)
Avail: NTIS HC A11/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

N78-11747# IBM Watson Research Center, Yorktown Heights, N.Y.
BEHAVIORAL ISSUES IN THE USE OF INTERACTIVE SYSTEMS
Lance A. Miller and John C. Thomas, Jr. 14 Dec. 1976 57 p refs
(Contract N00014-72-C-0419)
(AD-A043033; RC-6326) Avail: NTIS HC A04/MF A01 CSCL 09/2

This paper identifies behavioral issues related to the use of interactive computers primarily by persons who are not computer professionals, so-called 'general users.' This is not an exhaustive literature survey but instead provides: (1) a structure for discussing issues of interactive computing, and (2) the authors' best estimate of important behavioral problems, with suggestions for solutions. The discussion is limited to this paper to general issues which do not take into account the user's particular task. The two major topics are System Characteristics (performance, facilities, and on-line information), and Interface Characteristics (dialogue style, displays and graphics, other input/output media).
Author (GRA)

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N78-11748# Maryland Univ., College Park. Computer Science Center.
THRESHOLD EVALUATION TECHNIQUES
Joan S. Weszka Apr. 1977 108 p refs
(Contract F44620-72-C-0062)
(AD-A043410; AFOSR-77-0980TR; TR-531) Avail: NTIS HC A06/MF A01 CSCL 20/6

Threshold selection techniques have been used as a basic tool in image segmentation, but little work has been done on the problem of evaluating a threshold of an image. This paper addresses the problem of threshold evaluation and proposes two methods for measuring the goodness of a thresholded image, one based on a busyness criterion and the other based on a discrepancy or error criterion. These evaluation techniques are applied to both synthetic and real images, and are shown to be useful in facilitating threshold selection. In fact, both methods usually result in similar or identical thresholds which yield good segmentations of the images. Author (GRA)

N78-11749# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
OPTIMAL LINEAR CONTROL: CHARACTERIZATION OF MULTI-INPUT SYSTEMS Progress Report, 1 Dec. 1975 - 31 Mar. 1977
C. A. Harvey, G. Stein, and J. C. Doyle 9 Aug. 1977 60 p refs
(Contract N00014-75-C-0144)
(AD-A043771; HONEYWELL-77SRC34; ONR-CR215-238-2; TR-2) Avail: NTIS HC A04/MF A01 CSCL 12/1

This report presents results on characterizations of optimal multi-input systems. The major results are: (1) equivalence of quadratic state weighting to quadratic weighting of m responses where m is the dimension of the input, (2) characterization of quadratic performance indexes in terms of asymptotic eigenvalues and eigenvectors, (3) characterization of the effects of compensators on high frequency attenuation, and (4) development of a procedure for constructing quadratic performance indexes based on modal design specifications. Author (GRA)

N78-11750# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
PROBLEMS IN BUILDING AN INSTRUCTABLE PRODUCTION SYSTEM Interim Report
Michael D. Rychener, C. Forgy, P. Langley, J. McDermott, A. Newell, and K. Ramakrishna Jun. 1977 6 p refs Presented at IJCAI-77, Boston, Aug. 1977
(Contract F44620-73-C-0074)
(AD-A043472; AFOSR-77-1140TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

The Instructable Production System project is exploring the incremental growth properties of production systems (PSs) by constructing a generally intelligent problem solving system by gradual (external) instruction. The present task domain is an abstract job shop, in which finished goods are made from raw materials. We start with a Kernel (a small PS of about 200 productions) which has the basic capabilities to grow by instruction: (1) process a restricted natural language; (2) form productions from its input; (3) impose PS control conventions

on them; and (4) perform basic manipulations in its environment. (We take the basic computational and representational adequacy of PSs for AI programs as established.) This note presents some immediate difficulties that are expected. These derive from the instructional situation: (1) The instructor can observe the system in the environment and can communicate with it freely, but cannot examine its internal structure directly; (2) Interaction with the system is in an external language, analogous to natural language; (3) The initiative for interaction is mixed; (4) Instruction may be on any topic--specific tasks, general properties of tasks, the language of communication, possible errors, how to plan and explore, etc; and (5) Knowledge and system structure gained through instruction accumulates over the life of the system. The current approach uses means-ends analysis as the basic philosophy of both problem-solving and instruction. GRA

N78-11751# International Institute for Applied Systems Analysis, Laxenburg (Austria).
POLYHEDRAL DYNAMICS AND THE GEOMETRY OF SYSTEMS
R. Atkin (Essex Univ.) and J. Casti Mar. 1977 40 p refs
(IIASA-RR-77-6) Avail: NTIS HC A03/MF A01

A binary relation between two abstract sets is shown to be geometrically interpreted as a simplicial complex. Standard and nonstandard concepts from combinatorial topology are then employed to study the global connectivity structure of the complex. Classical notions such as homology are illustrated by examples chosen from various fields. The connection between the standard differential equation defintion of a dynamical system and the polyhedral dynamic set-up is explored in some detail. It is shown that the complex associated with a linear system provides a very illuminating paradigm within which new interpretations of open- and closed-loop control laws are possible. A discussion of topics for future investigation is presented. Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N78-11752 Wisconsin Univ., Madison.
A COMPARATIVE STUDY OF COMPUTATIONAL REQUIREMENTS FOR SOLUTION OF DIAKOPTIC EQUATIONS Ph.D. Thesis
Mohammed Bahari-Kashani 1976 289 p
Avail: Univ. Microfilms Order No. 77-8776

The concept of diakoptics was used to analyze an electrical or mechanical network by partitioning it into a number of smaller sections. This was done by tearing through a few nodes or removing a few elements. The solution of the entire network was obtained by analyzing these torn components together with a set of equations for the sectioned remainder of the network; these equations include the effect of the torn components.
Dissert. Abstr.

N78-11753 California Univ., Berkeley.
ON CERTAIN REFLEXIVE OPERATOR ALGEBRAS Ph.D. Thesis
David Royal Larson 1976 71 p
Avail: Univ. Microfilms Order No. 77-15753

The structure and related properties of certain reflexive operator algebras acting on Hilbert space were studied with emphasis on nest algebras. The R-commutant of the core is defined to be the class of all operators that commute with every member of the core modulo the Jacobson radical of the nest algebra. Observing that members of the radical behave like compact operators in a certain sense, it is shown that the R-commutant of the core of a nest algebra is the direct sum of the algebraic commutant of the core and the Jacobson radical. Those projections that commute with every member of the nest algebra modulo its radical are described along with the R-center of a nest algebra. It is shown that certain of the relevant invariance properties of a nest algebra can be characterized in terms of its idempotent structure and that to solve the multiplicity problem for the case of a nonatomic multiplicity free nest in separable Hilbert space it will suffice to show that for every operator A in the nest algebra with A(2) = I there is an operator B invertible in the nest algebra with A*A + I = B*B. Dissert. Abstr.

N78-11754 Purdue Univ., Lafayette, Ind.
BEST APPROXIMATION BY CONSTRAINED SPLINES Ph.D. Thesis
Dennis Dale Pence 1976 137 p
Avail: Univ. Microfilms Order No. 77-15452

Existence, characterization, and partial uniqueness is investigated for best uniform approximation by polynomial splines of some fixed degree with fixed knots which satisfy certain linear constraints. A general theory is developed for best global approximation in a real normed linear space by elements of a linearly constrained subset of a finite dimensional subspace with respect to certain continuous semi-norms. The theorems developed are expressed in terms of error-extremal and constraint-extremal linear functionals in the dual space, often in terms of a critical or in a sense a minimal set of such linear functionals. For the spline applications of the general theory, certain interpolation and zero properties of polynomial splines are needed. A theorem concerning Hermite-Birkhoff interpolation by splines is presented. This is used to characterize and obtain partial uniqueness for restricted derivative range approximation by splines.
Dissert. Abstr.

N78-11755 California Univ., Berkeley.
EXTENSIONS OF PRO-AFFINE ALGEBRAIC GROUPS Ph.D. Thesis
Brian Lee Peterson 1976 87 p
Avail: Univ. Microfilms Order No. 77-15818

Reductions are considered for computing Ext in the category of pro-affine algebraic groups over an algebraically closed field of characteristic 0. The faithfulness and transitivity of the usual Baer action of Ext(H,C) on Ext(H,A) are obtained, where C denotes the center of A, and the usual exact sequences expressing the functional properties of Ext, in a categorical setting general enough to include this category and also those of locally compact separable topological groups, separable real or complex Lie groups, and abstract groups. Examination of the multiplicative character theory for pro-affine algebraic groups over an algebraically closed field F of characteristic p, shows that it provides a contravariant categorical equivalence from the category of reductive Abelian pro-affine algebraic groups over F to the category of Abelian groups without p-torsion, or just Abelian groups if p=0.
Dissert. Abstr.

N78-11756# Denver Research Inst., Colo. Div. of Mathematical Sciences.
ASYMPTOTIC EXPANSIONS OF INTEGRALS WITH OSCILLATORY KERNELS AND LOGARITHMIC SINGULARITIES
Judith A. Armstrong and Norman Bleistein 20 Jul. 1977 19 p refs
(Contract N00014-76-C-0039)
(AD-A043155; MS-R-7718) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper is a follow-up to an earlier paper which derived asymptotic expansions of integral transforms of functions with logarithmic singularities. That result dealt with exponentially decaying kernels. In this paper the results are expanded to include the case of oscillatory kernels - e.g., Fourier or Hankel transforms. Author (GRA)

N78-11757# Ballistic Research Labs., Aberdeen Proving Ground, Md.
COMMENTS ON THE SOLUTION COUPLED STIFF DIFFERENTIAL EQUATIONS Final Report
M. D. Kregel and J. M. Heimerl Jul. 1977 22 p refs
(AD-A043122; BRL-MR-2769) Avail: NTIS HC A02/MF A01 CSCL 12/1

The K-method of integrating sets of ordinary differential equations is outlined. This algorithm employs a variable step size, third order predictor-corrector method. It is written to reduce truncation error and to maximize stability consistent with reasonable execution time. The K-method has been used to integrate equations with discontinuous driving functions and this algorithm conserves chemical balance within the machine

round-off error. It has been applied to solve kinetics problems in aeronomy and examples are taken from that field.
Author (GRA)

N78-11758# Chicago Univ., Ill.
RELATIONS BETWEEN COMPLEMENTARY PIVOTING ALGORITHMS AND LOCAL GLOBAL NEWTON METHODS
C. B. Garcia and F. J. Gould 1977 36 p refs
(Contract N00014-75-C-0495; Grant NSF ENG-76-81058)
(AD-A043089) Avail: NTIS HC A03/MF A01 CSCL 12/1
This paper relates a simplicial pivot algorithm to Merrill's algorithm, Newton's method, and a global Newton method presented by Smale. Some computational results are given. GRA

N78-11759# Yale Univ., New Haven, Conn. Dept. of Statistics.
ASYMPTOTIC DISTRIBUTIONS OF LATENT ROOTS IN CANONICAL CORRECTION ANALYSIS AND IN DISCRIMINANT ANALYSIS WITH APPLICATIONS TO TESTING AND ESTIMATION
William J. Glynn Jun. 1977 147 p refs
(Contract N00014-75-C-0563)
(AD-A043772; TR-43) Avail: NTIS HC A12/MF A01 CSCL 12/1
The principal aim of this research is to derive asymptotic expansions for the distributions of latent roots which occur in canonical correlation analysis and in discriminant analysis. The results are used to obtain estimates of the population roots and to study tests that some of the population roots are zero. GRA

N78-11760# Florida Univ., Gainesville. Center for Mathematical Study Theory.
ON THE EXISTENCE OF MINIMAL REALIZATIONS OF LINEAR DYNAMICAL SYSTEMS OVER NOETHERIAN INTEGRAL DOMAINS Interim Report
Yves Rouchaleau (Centre d'Automatique, Fontainebleau, France) and Eduardo D. Sontag Aug. 1976 22 p refs
(Grants AF-AFOSR-2268-72; DAHC04-74-G-0153)
(AD-A043671; AFOSR-77-0946TR) Avail: NTIS HC A02/MF A01 CSCL 12/1
This paper studies the problem of obtaining minimal realizations of linear systems over commutative rings. Connections are given with some deep questions in commutative algebra.
Author (GRA)

N78-11761# Florida Univ., Gainesville. Center for Mathematical System Theory.
RESEARCH IN APPLIED MATHEMATICS RELATED TO MATHEMATICAL SYSTEM THEORY Final Report, 1 May 1975 - 18 Apr. 1977
R. E. Kalman Jun. 1977 9 p refs
(Grants DAHC04-74-G-0153; DAAG29-76-G-0011)
(AD-A043373; ARO-10668.7-M) Avail: NTIS HC A02/MF A01 CSCL 12/1
This report deals with research results obtained in the field of mathematical system theory. Special emphasis was given to the following areas: (1) Linear system theory over a field: parametrization of multi-input, multi-output systems and the geometric structure of classes of systems of constant dimension. (2) Linear systems over a ring: development of the theory for very general classes of rings. (3) Nonlinear system theory: basic properties of polynomial (discrete-time) systems and their realization theory. The present report is only a brief summary of findings, which are far too technical to be explained in a few pages. The results are being gradually published in the open literature. For details, refer to previous proposals and/or to the publications listed in the references. GRA

N78-11762# Florida Univ., Gainesville. Center for Mathematical System Theory.
ON THE OBSERVABILITY OF POLYNOMIAL SYSTEMS Interim Report
Eduardo D. Sontag 1977 11 p refs
(Grants AF-AFOSR-2268-72; DA-ARO(D)-31-124-72-G114)
(AD-A043672; AFOSR-77-0917TR) Avail: NTIS HC A02/MF A01 CSCL 12/1
Four natural notions of observability are compared in the case of systems described by polynomial difference equations. The main result states that, for a system having the standard property of (multiple-experiment initial-state) observability, the response to almost any (long-enough) input sequence is sufficient for final-state determination. Author (GRA)

N78-11763# Air Force Academy, Colo.
A STUDY OF TUNABLE INTEGRATION AND CONTROL THEORY FOR THE ANALYSIS OF DIFFERENTIAL EQUATION SOLVERS Final Report, Jan. 1975 - Dec. 1976
Marc L. Sabin May 1977 75 p refs
(AF Proj. 2304)
(AD-A043733; FJSRL-TR-77-0006) Avail: NTIS HC A05/MF A01 CSCL 12/1
Tunable integration is an approach to the numerical solution of ordinary differential equations that is conceived, developed, and employed based upon the principles of linear control theory. The properties of the zero-order-hold tunable integrator and the control-theory methods used to analyze those properties are equally important in the context of this report. Beginning with a discussion of numerical error from a control-theory perspective, the concept is presented of an ideal integrator having no error but that due to finite computer word length. The lack of adaptability of the ideal integrator motivates the tunable integrator, which possesses the requisite flexibility. The majority of the report covers the analytic development of tunable integration, the frequency response of the zero-order-hold tunable integrator, and a root-locus analysis of that integrator as employed in a first-order, linear system. Throughout the presentation, emphasis is placed on the use of these control-theory techniques to determine stability and to tune the integrator for improved performance. GRA

N78-11764# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
MINIMAX RIDGE REGRESSION ESTIMATION Interim Report
George Casella May 1977 51 p refs
(Grant AF-AFOSR-2350-72; AF Proj. 2304)
(AD-A043489; Mimeo-Ser-497; AFOSR-TR-77-1146) Avail: NTIS HC A04/MF A01 CSCL 12/1
The technique of ridge regression has become a popular tool for data analysts faced with a high degree of multicollinearity in their data. By using a ridge estimator, it was hoped that one could both stabilize the estimates (lower the condition number of the design matrix) and improve upon the squared error loss of the least squares estimator. Recently classes of ridge regression estimators have been developed which dominate the usual estimator in risk, and hence are minimax. This paper derives conditions that are necessary and sufficient for minimaxity of a large class of ridge regression estimators. The conditions derived here are very similar to those derived for minimaxity of some Stein-type estimators. GRA

N78-11765# California Univ., Livermore. Lawrence Livermore Lab.
AREA OF INTERSECTION OF ARBITRARY POLYGONS
S. I. Warshaw Mar. 1977 46 p refs
(Contract W-7405-eng-48)
(UCID-17430) Avail: NTIS HC A03/MF A01
The geometric aspects of calculating the area or volume of the region of overlap between two intersecting arbitrary polygons are considered in detail, for the purpose of adapting them to a workable algorithm suitable for a digital computer. Such an algorithm is described, and certain floating point arithmetic errors which occur that are detrimental to the operation of the algorithm are also discussed. Methods for circumventing these difficulties are presented. ERA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N78-11766 Kent State Univ., Ohio.
A MONTE CARLO COMPARISON OF PARAMETER ESTIMATES BY THE METHOD OF MOMENTS AND AN

APPROXIMATE METHOD OF MAXIMUM LIKELIHOOD FOR THE UNIVARIATE BETA DISTRIBUTION Ph.D. Thesis
Kristofer Claude Neslund 1976 99 p
Avail: Univ. Microfilms Order No. 77-16045

The first of the principal findings of this research was the determination that both the method of moments and approximate maximum likelihood method yield estimators which are biased, but asymptotically unbiased, and mean square error consistent. In terms of relative properties, the method of moments estimators tended to be less biased when neither of the true parameter values were .5, but the approximate maximum likelihood estimators were less biased when either parameter equaled .5; they were always more efficient and had a smaller mean square error. This information was used to make a recommendation about which estimation technique should be used given a specified sample size. It was concluded that the approximate likelihood method should always be used when it can be assumed that the one or both of the true parameter values are fractional. Such an assumption can be made by plotting the collected data and visually determining whether one or two parabolic tails are developing. When so, the inference is that one or both of the true parameters are fractional. When this assumption cannot be made, a trade-off between desirable estimator properties and time/cost factors develops. Dissert. Abstr.

N78-11767 American Univ., Washington, D. C.
ON EXTREME VALUES OF A MARKOV MAXIMUM POINT PROCESS Ph.D. Thesis
Michel Kazuo Ochi 1977 70 p
Avail: Univ. Microfilms Order No. 77-17743

The effect of statistical dependence of the maxima (peak values) of a stationary random process on the magnitude of the extreme values is discussed. The extreme value is defined as the largest peak value in a certain number of observations. A theoretical analysis of the extreme values of a stationary normal random process is made, assuming the maxima are subject to the Markov chain condition. For this, the probability distribution function of maxima as well as the joint probability distribution function of two successive maxima of a normal process having an arbitrary spectral band-width are presented. Then, these two probability distribution functions are used with Epstein's formula for evaluating the extreme values in a given sample under the Markov chain condition. A numerical evaluation of the extreme values is then carried out for a total of 14 random processes with various spectral band-width parameters ranging from 0.11 to 0.78. Dissert. Abstr.

N78-11768 California Univ., Berkeley.
ON THE ESTIMATION AND VARIANCES OF BASIC AND DERIVED PARAMETERS IN A CONTINUOUS TIME MARKOV PROCESS WITH AN EXAMPLE Ph.D. Thesis
Philip Frederick Rust 1976 98 p
Avail: Univ. Microfilms Order No. 77-15843

Among the functions of parameters, is the variance of duration of stay. Through some new matrix relationships, this function is given not only for the relatively simple asymptotic case but also for finite values of the time argument. Other contributions describe some facets of the expected duration of stay matrix. Partial derivatives of this matrix with respect to the fundamental Markov intensity parameters are found, permitting advances in other areas. Variances and covariances of estimated expected durations of stay are allotted much attention as useful extensions of the asymptotic maximum likelihood procedure. The offering of alternative methods occurs repeatedly. The use of eigenvalues is known to be a powerful tool to obtain functions of the intensity matrix, but it was decided that the contributions of the infinite series technique also should be investigated and presented. Both Taylor series and numerical integration are offered as valid ways of obtaining formulas to evaluate covariances of expected durations of stay. A simple estimation procedure is stated as a possible rival to the sophisticsted, asymptotically consistent and efficient, maximum likelihood procedure. Dissert. Abstr.

N78-11769 North Carolina Univ., Chapel Hill.
SOME STATISTICAL PROCEDURES BASED ON DISTANCES Ph.D. Thesis
Joseph James Walker 1976 111 p
Avail: Univ. Microfilms Order No. 77-17493

A criterion is proposed for classifying multivariate observations according to their populations of origin when the observable data are the distances between pairs of observations, with these distances themselves subject to further variation, such as measurement error. The same basic problem is investigated under several assumptions on the underlying normal distributions. In each case, the criterion is shown to be a particular quadratic form in normal variables. In the simplest case considered, a computational form for the distribution is given. An asymptotic expansion is developed which provides an approximation to the distribution in other cases. The accuracy of the approximation is investigated numerically. Dissert. Abstr.

N78-11770 Kentucky Univ., Lexington.
ON THE STOCHASTIC THEORY COMPARTMENTS Ph.D. Thesis
Daniel Lee Weiner 1976 85 p
Avail: Univ. Microfilms Order No. 77-15983

Recently much work has been done on the use of compartmental models in Pharmacokinetics. A general discussion is given of such compartmental models along with a discussion of the literature in the area. One of the most frequently employed compartmental models is the mammillary model and consists of a central compartment and some number of peripheral compartments. The central compartment usually denotes blood plasma and the peripheral compartments various other tissues. Due to widespread use of this model in the literature, it was studied in detail. A framework for analyzing an arbitrary n-compartment system is then presented. Dissert. Abstr.

N78-11771 Johns Hopkins Univ., Baltimore, Md.
ASYMPTOTIC BEHAVIOR OF POSTERIOR DISTRIBUTIONS AND BAYES'S ESTIMATORS FOR THE INDEPENDENT NOT IDENTICALLY DISTRIBUTED CASE Ph.D. Thesis
Margaret C. Wu 1974 124 p
Avail: Univ. Microfilms Order No. 77-16560

The convergence of a posterior distribution in variation to a normal distribution is studied for the case of independent not identically distributed (i.n.i.d.) random variables. Examples of observations that are i.n.i.d. occur in regression models and in estimation under variable censoring. Let a random sample of size n be taken from i.n.i.d. populations with their distributions depending on the common parameters. Conditions are established under which the posterior distribution converges in variation to a normal distribution. The existence of an asymptotic expansion for the posterior distribution and the asymptotic equivalence of maximum likelihood and Bayes' estimators, under a class of loss functions, are proven. Dissert. Abstr.

N78-11772 American Univ., Washington, D. C.
STABILITY CONSIDERATIONS FOR HIERARCHICAL CLUSTERING SCHEMES INVOLVING MULTIDIMENSIONAL CATEGORICAL VARIABLES Ph.D. Thesis
Rolf Melvin Wulfsberg 1977 116 p
Avail: Univ. Microfilms Order No. 77-16819

The increasing popularity of cluster analysis has led to the development of a large collection of hierarchical clustering algorithms. If the researcher's data is incomplete or partially erroneous, one of the most important considerations in selecting an appropriate clustering scheme must be the stability of the scheme. Through a series of Monte Carlo experiments based on the random generation of erroneous or incomplete similarity matrices, this study examines the following questions concerning the stability of hierarchical clustering schemes. Dissert. Abstr.

N78-11773 California Univ., Berkeley.
A NEW METHOD OF APPROXIMATION TO VARIOUS DISTRIBUTIONS ARISING IN TESTING PROBLEMS Ph.D. Thesis
Winston Kai-Wan Chow 1976 109 p
Avail: Univ. Microfilms Order No. 77-15636

The method which considers L as the exponential of a quadratic polynomial was studied. The three coefficients for this quadratic polynomial were chosen such that the moments of order 0, 1, and 2 for R were identical to those of Q. Hence R was a genuine distribution function. Under very mild conditions, the coefficients were proven to exist. The method was applied to approximate the distributions of the one-sample and two-sample

Wilcoxon statistics. The results were shown to be very adequate even for some cases when the sample size was as small as 5.
Dissert. Abstr.

N78-11774 New Mexico Univ., Albuquerque.
THE USE OF PRIOR OBSERVATIONS IN CONSTRUCTING PREDICTION INTERVALS FOR THE NORMAL DISTRIBUTION Ph.D. Thesis
Charles Benjamin Davis 1976 84 p
Avail: Univ. Microfilms Order No. 77-16094

In the empirical Bayes setting, it is assumed that the present normal population is embedded in a sequence of such populations with common variance and with means being randomly drawn from the prior distribution. Prediction interval procedures are derived which render the usual procedure (which ignores prior information) inadmissible. Numerical studies of the magnitude of the improvement offered by the need procedures over the old are presented. The new procedures are adapted to three common problems: (1) predicting the mean for future observations; (2) producing a confidence interval for the mean of the present population; and (3) producing an interval which will contain all of the next observations with confidence. Dissert. Abstr.

N78-11775 Maryland Univ., College Park.
AN EMPIRICAL INVESTIGATION OF THE FISHER Z TRANSFORMATION IN COMPARING TWO MULTIPLE CORRELATIONS Ph.D. Thesis
Roberta Williams Day 1976 116 p
Avail: Univ. Microfilms Order No. 77-16366

The purpose of this study was to investigate the accuracy of the Fisher Z transformation in tests for equality of two multiple correlations (R's) in independent samples from the same multivariate normal population. In addition, the accuracy of centered Z's and Z transformations of shrunken R's was investigated. Centered Z's were based upon a procedure for centering the distribution of sample Z's on the population value of Z. The problem was investigated by means of Monte Carlo simulations on a computer. Three thousand pairs of samples of multivariate pseudo-random normal deviates were generated in each of 32 selected design combinations symbolized by a descriptor. Dissert. Abstr.

N78-11776 Kentucky Univ., Lexington.
SOME NONPARAMETRIC TESTS OF RANDOMNESS AND OF ORDERED ALTERNATIVES Ph.D. Thesis
Ghanshyam D. Gupta 1976 104 p
Avail: Univ. Microfilms Order No. 77-15946

Three different problems are considered. In each case a locally most powerful (LMP) rank test was obtained. A generalized form of the theorem of Hajek and Sidak (1967) was used for the derivation of the test statistics. A distribution-free test of randomness against multivariate normal alternatives with specific forms for the correlation matrices depending on a single parameter was derived. Next, a LMP rank test of homogeneity of scale against ordered normal alternatives was ascertained. Finally, a LMP rank test of ordered location alternatives was derived for the incomplete block model. Incompleteness did not have the usual meaning, but it means that within each block measurements on treatments administered towards the end were missing.
Dissert. Abstr.

N78-11777 Washington Univ., Seattle.
SEQUENTIAL TESTS FOR A MULTINOMIAL DISTRIBUTION Ph.D. Thesis
Susan Edith Hodge 1976 126 p
Avail: Univ. Microfilms Order No. 77-16729

The problem of sequentially testing for zero mean in a multi-nomial distribution with a natural ordering (symmetric about zero) of the categories is considered. The problem is of interest in evaluating multinomially distributed responses to a medical treatment, an opinion poll, etc. An approach is to assume that the distribution arises from the grouping of a normal variable. A variety of tests are considered: (1) a straightforward SPRT based on the ratios of the multinomial probabilities, (2) tests of symmetry, (3) tests which treat the discrete variable as if it were normal, and (4) a generalized test based on the asymptotic normal behavior of the MLE for the mean. When the variance is assumed known, (1) and (3) are the most efficient in general, although one of the other tests may be preferable under certain circumstances. When the variance is unknown, (2) can be used as is, but the others require preliminary variance estimation.
Dissert. Abstr.

N78-11778*# Houston Univ., Tex. Dept. of Mathematics.
CHARACTERIZATIONS OF LINEAR SUFFICIENT STATISTICS
B. Charles Peters, Jr., Richard Reoner, and Henry P. Decell, Jr. Oct. 1977 14 p refs
(Contract NAS9-15000)
(NASA-CR-151551; Rept-65) Avail: NTIS HC A02/MF A01 CSCL 12A

A surjective bounded linear operator T from a Banach space X to a Banach space Y must be a sufficient statistic for a dominated family of probability measures defined on the Borel sets of X. These results were applied, so that they characterize linear sufficient statistics for families of the exponential type, including as special cases the Wishart and multivariate normal distributions. The latter result was used to establish precisely which procedures for sampling from a normal population had the property that the sample mean was a sufficient statistic.
Author

N78-11779# Texas Univ., Austin. Dept. of Electrical Engineering.
SOME PRELIMINARY RESULTS ON DETECTION IN LAPLACE NOISE Interim Report
Robert J. Marks, Gary L. Wise, John L. Whited, and Douglas G. Haldeman 1977 7 p refs Presented at the 1977 Conf. on Inform. Sci. and Systems, Austin, 30 Mar. - 1 Apr. 1977 Submitted for publication
(Contract AF-AFOSR-3062-76)
(AD-A043231; AFOSR-77-0993TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The problem of the discrete time detection of a known constant signal in additive white stationary Laplace noise is considered. Both the Neyman-Pearson optimal detector and the linear detector are treated. Convenient expressions for the distribution functions of the test statistics are given. These expressions allow one to determine the performance of the detectors in a computational convenient manner. Author (GRA)

N78-11780# Florida State Univ., Tallahassee. Dept. of Statistics.
PREDICTION INTERVALS WITH THE DIRICHLET PRIOR Interim Report
Gregory Campbell and Myles Hollander Jun. 1977 22 p refs
(Grant AF-AFOSR-3109-76; AF Proj. 2304)
(AD-A043279; FSU-Statistics-M422; AFOSR-77-0951TR; TR-4) Avail: NTIS HC A02/MF A01 CSCL 12/1

Let X sub 1, X sub n and Y1, Y sub n be consecutive samples from a Dirichlet process on (R, B) (the real line R with the Borel sigma field B) with parameter alpha. Typically, prediction intervals employ the previous observations X sub 1, X sub n in order to predict a specified function of the future sample Y sub 1, Y sub n. Here one- and two- sided prediction intervals for at least k of N future observations are developed for the situation in which, in addition to the previous sample, there is prior information available. The information is specified via the parameter alpha of the Dirichlet process. Author (GRA)

N78-11781# Florida State Univ., Tallahassee. Dept. of Statistics.
NONPARAMETRIC BAYES ESTIMATION WITH INCOMPLETE DIRICHLET PRIOR INFORMATION Interim Report
Gregory Campbell and Myles Hollander Jun. 1977 23 p refs
(Grant AF-AFOSR-3109-76; AF Proj. 2304)
(AD-A043278; FSU-Statistics-M418; AFOSR-77-0952TR; TR-3) Avail: NTIS HC A02/MF A01 CSCL 12/1

Typically, to use estimators which are Bayes with respect to Ferguson's Dirichlet process prior, the statistician must provide a complete specification of the process parameter alpha, a non-negative non-null finite measure on a measureable space (X, A). Here we take X - R, the real line, and A - B the Borel sigma-field. Mixed rules (rules which minimize the average maximum risk) are derived for estimating Pr(X or Y) and for

estimating rank order. These estimators are incomplete information analogues of Fergusons Bayes estimator of Pr(X or Y) and the Campbell-Hollander Bayes estimator of rank order. GRA

N78-11782# Illinois Univ., Chicago. Dept. of Mathematics.
ON SCHEFFE'S S-METHOD: A REVIEW
A. Hedayat Aug. 1977 27 p refs
(Grant AF-AFOSR-3050-76)
(AD-A043493; AFOSR-77-1147TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper gives, in detail, the background and derivation of a simultaneous statistical inference in linear models which is commonly known as Scheffe S-method. It is written for a person with a knowledge of linear models and design of experiment. It also gives a list of 46 references related to the subject. Author (GRA)

N78-11783# Florida State Univ., Tallahassee. Dept. of Stastics.
AN INEQUALITY FOR CONVEX FUNCTIONS INVOLVING G-MAJORIZATION
Ramon V. Leon and Frank Proschan Jul. 1977 9 p refs
(Grant AF-AFOSR-2581-74)
(AD-A043490; FSU-Statistics-M412; AFOSR-77-1148TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper is derived a simple inequality involving expectations of convex function and the notion of G-majorization. Useful applications of the more general inequality are presented. GRA

N78-11784# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Statistics.
MULTIVARIATE DISTRIBUTIONS HAVING WEIBULL PROPERTIES
Larry Lee Aug. 1977 16 p refs
(Contract N00014-76-C-0788)
(AD-A043404) Avail: NTIS HC A02/MF A01 CSCL 12/1

Random variables X sub 1, ..., X sub n are said to have a joint distribution with Weibull minimums after arbitrary scaling if minimum over i of A sub i, X sub i has a one dimensional Weibull distribution for arbitrary constants A sub i greater than or equal to 0, i = 1, ..., n. Some properties of this class are demonstrated, and some examples are given which show the existence of a number of distributions belonging to the class. One of the properties is found to be useful for computing component reliability importance. The class is seen to contain an absolutely continuous Weibull distribution which can be generated from independent uniform and gamma distributions. GRA

N78-11785# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
PROBABILITY AND STATISTICS AND APPLICATIONS Final Report, 1 Jun. 1972 - 31 May 1977
Leon J. Gleser, David S. Moore, and Marcel F. Neuts Jul. 1977 35 p refs
(Contract N00014-67-A-0226-00014; Grant AF-AFOSR-2350-72)
(AD-A043463; AFOSR-77-1004TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The report covers progress made in the areas of inference for multivariate errors-in-variables regression models, minimax estimation for normal means and for slopes in linear regression models, sequential interval estimation, integer programming, search theory, chi-squared goodness of fit tests, density estimation, computational probability, queueing theory, and various models for stochastic processes. The major results obtained in each of these areas are summarized. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N78-11786# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
HYPOTHESIS TESTING AND STATE ESTIMATION FOR DISCRETE SYSTEMS WITH FINITE-VALUED SWITCHING PARAMETERS Interim Report
C. B. Chang and M. Athans 1 Jun. 1977 27 p refs
(Grant AF-AFOSR-3281-77; AF Proj. 2304)
(AD-A043099; ESL-P-758; AFOSR-77-0836TR) Avail: NTIS HC A03/MF A01 CSCL 12/2

This paper considers the problem of state estimation for discrete systems with parameters which may be switching within a finite set of values. In the general case it is shown that the optimal estimator requires a bank of elemental estimators with its number growing exponentially with time. For the Markov parameter case, it is found that the optimal estimator requires only N squared elemental estimators where N is the number of possible parameter values. GRA

N78-11787# Massachusetts Inst. of Tech., Cambridge. Dept. of Mathematics.
ON THE STRICT DETERMINATION OF HYPOTHESIS TESTING GAMES
Richard Clark Persons 22 Jul. 1977 32 p refs
(Contract N00014-76-C-0555)
(AD-A043201; TR-6) Avail: NTIS HC A03/MF A01 CSCL 12/1

Measurably parameterized subsets of the set of all probability measures on a space are examined. The setup involves an arbitrary composite null hypothesis and the complementary alternative hypothesis. Suppose that for every probability measure on the parameter space, the averaged null hypothesis measure is orthogonal to the averaged alternative hypothesis measure. Whether, there then exists a Borel set in the range space which separates the null and alternative hypotheses is explored. It is shown that, in cases usually considered in hypothesis testing, there does exist such a Borel set. The relevance to this question to Bayesian vs. classical statistics is also discussed. Author (GRA)

N78-11788# International Institute for Applied Systems Analysis, Laxenburg (Austria).
PITFALLS OF ANALYSIS AND THE ANALYSIS OF PITFALLS
Giandomenico Majone Jan. 1977 26 p refs
(IIASA-RM-77-1) Avail: NTIS HC A03/MF A01

The literature of applied systems has devoted considerable attention to the treatment of pitfalls. A two-way extension of previous discussions is presented: by introducing a new categorization of pitfalls; and by examining their epistemological, technical, and conceptual roots. Analytic pitfalls are grouped around four rubrics that closely correspond to the four components of the analytic task: a) problem setting, data, and information; b) tools and methods; c) evidence and argument; and d) conclusions, communication, and implementation. A number of examples are discussed, and it is argued that analytic methods and techniques can be best understood in terms of the pitfalls they are designed to circumvent. Author (ESA)

N78-11789# International Institute for Applied Systems Analysis, Laxenburg (Austria).
A PRACTICAL APPROACH TO CHOOSING ALTERNATE SOLUTIONS TO COMPLEX OPTIMIZATION PROBLEMS UNDER UNCERTAINTY
Lev S. Belyaev Jan. 1977 58 p refs
(IIASA-RM-77-7) Avail: NTIS HC A04/MF A01

The methods described are aimed at the greatest possible formalization of the solution process, at the correct evaluation of consequences associated with this or that decision, and at the elaboration of recommendations for decision makers. The application of these methods allows reduction of negative consequences (damage, over-expenditure, risk), which are conditioned by inexact knowledge of the future. They are not able, however, to avoid these consequences or uncertainties in decision making completely. In general, some risks do inevitably exist and mathematical methods cannot provide the single optimal solution. One can only determine a set of rational variants which are good in this or that sense, but the final choice inevitably has to be made by man (decision maker) himself. Author (ESA)

N78-11790# International Institute for Applied Systems Analysis, Laxenburg (Austria).

ON THE THEORY OF MAX-MIN
A. Propoi Mar. 1977 26 p refs
(IIASA-RM-77-13) Avail: NTIS HC A03/MF A01

An approach to the solution of max-min problems which takes into account the peculiarities of both the external (max) and the internal (min) operations was considered. The solution allows developing a set of methods for the solution of different kinds of max-min problems, including multistage max-min problems, and max-min problems with linked constraints, etc.
Author (ESA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N78-11791 South Florida Univ., St. Petersburg.
ON GENERALIZATIONS OF CONTINUITY Ph.D. Thesis
David Alon Rose 1977 153 p
Avail: Univ. Microfilms Order No. 77-16907

Characterizations are found for the prominent independent generalized continuity conditions: weak continuity and almost continuity. Conditions for interdependence of these two generalizations of continuity are also found. A mapping condition is sought which when combined with almost continuity will yield continuity. This leads to the notion of strong semi-continuity. It is known that weak continuity plus weak* continuity is equivalent to continuity. Hear weak* continuity is replaced by local weak* continuity whereby a pure topological version of the closed graph theorem is obtained for a function into a strongly locally compact space. Many theorems treated individually are shown to have a common basis from which them stem. Thus a unification of some of the heretofore disjointed results is established.
Dissert. Abstr.

N78-11792 New York Univ., N. Y.
RECURSIVELY ENUMERABLE IMAGES OF ARITHMETIC SETS Ph.D. Thesis
Richard Marshall Rosenberg 1976 42 p
Avail: Univ. Microfilms Order No. 77-16517

The pseudo-complement function N sub alpha is examined, and the relationships between the functions were investigated. A section is included explaining the notation used and outlining some of the results needed to define Q sub alpha. Q sub alpha is formally defined. Its interactions with the wedge functions conjunction and disjunction of recursion theory was studied. It is shown that applying the pseudo-complement after the provability function always yields the empty set. Dissert. Abstr.

N78-11793 Florida Univ., Gainesville.
VECTOR INTEGRATION IN TENSOR PRODUCT SPACES AND COMPACTNESS IN LEBESQUE-TYPE SPACES Ph.D. Thesis
Eben Ros Limsui 1976 91 p
Avail: Univ. Microfilms Order No. 77-17055

The integration theory of a vector valued function was studied, with respect to a vector measure taking its values in the tensor product of two Banach spaces and a characterization of compactness in the Lebesque-type spaces. From basic theorems in measure theory and tensor products, the theory of integration of vector valued functions was developed, with respect to a vector measure. Bochner-type integrable functions, Dunford-Schwartz type integrable functions, and weakly integrable functions were defined. An integrable function space defined similarly to that developed by Story is a Banach space. Integral representations of linear operators on function spaces also were considered. Dissert. Abstr.

N78-11794 California Univ., Berkeley.
ALGEBRAIC CLOSURE OPERATORS AND CONSTRUCTIONS IN RING THEORY Ph.D. Thesis
Peter Malcolmson 1976 91 p
Avail: Univ. Microfilms Order No. 77-15779

Suppose R yields S is a homomorphism of associative rings. For X, a subset of a finitely generated free right R-module R sup n, the S-closure of X was defined to be the set of elements of R sup n whose images in S sup n were S-linear combinations of images of elements of X. The inverse problem of construction in a natural way a ring S was also studied. Dissert. Abstr.

N78-11795# Florida Univ., Gainesville. Center for Mathematical System Theory.
ON SPLIT REALIZATIONS OF RESPONSE MAPS OVER RINGS
Eduardo D. Sontag Jul. 1976 21 p refs
(Grant AF-AFOSR-2268-72; AF Proj. 2304)
(AD-A043419; AFOSR-77-0916TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper deals with observability properties of realizations of linear response maps defined over commutative rings. A characterization is given for those maps which admit realizations which are simultaneously reachable and observable in a strong sense.
Author (GRA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N78-11796# Technische Univ., Berlin (West Germany). Sonderforschungsbereich Magnetohydrodynamik.
STABILITY OF FREE LAYERS BETWEEN CONDUCTING AND INSULATING FLUIDS IN A TRANSVERSAL MAGNETIC FIELD AT FINITE VALUES OF THE MAGNETIC REYNOLDS NUMBER [UEBER DIE STABILITAET FREIER GRENZSCHICHTEN ZWISCHEN LEITENDEN UND ISOLIERENDEN FLUIDEN]
Peter Plaschko Sep. 1975 29 p refs In GERMAN; ENGLISH summary
(SFB-MHD-23) Avail: NTIS HC A03/MF A01

A theoretical study is presented of the stability of free conducting shear layers in a transverse magnetic field in the range of finite magnetic Reynolds numbers. In the special case of a layer between insulating and conducting fluids and with restriction to plane disturbances it is shown that in the idling motion case as well as in the case of small deviations from it, the influence of the magnetic Reynolds number and the Hartmann number is comparatively small and the interaction parameter is the most important MHD parameter of the problem.
Author (ESA)

N78-11797# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 20
26 Oct., 1977 65 p Transl., into ENGLISH from Russian journals
(JPRS-70030) Avail: NTIS HC A04/MF A01

Topics discussed include: development prospects in the state network of computer centers, automated control systems in Uzbek, information exchange and data retrieval; scientific potential of universities, cooperation between university research and industry, and scientific progress in Kzazkhstan and in Estonia. A.R.H.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N78-11798*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A FINITE ELEMENT SIMULATION OF SOUND ATTENUATION IN A FINITE DUCT WITH A PERIPHERALLY VARIABLE LINER
Willie R. Watson Oct. 1977 41 p refs Presented at 4th Aeroacoust. Conf., Atlanta, 3-5 Oct. 1977
(NASA-TM-74080) Avail: NTIS HC A03/MF A01 CSCL 20A

Using multimodal analysis, a variational finite element method is presented for analyzing sound attenuation in a three-dimensional

finite duct with a peripherally variable liner in the absence of flow. A rectangular element, with cubic shaped functions, is employed. Once a small portion of a peripheral liner is removed, the attenuation rate near the frequency where maximum attenuation occurs drops significantly. The positioning of the liner segments affects the attenuation characteristics of the liner. Effects of the duct termination are important in the low frequency ranges. The main effect of peripheral variation of the liner is a broadening of the attenuation characteristics in the midfrequency range. Because of matrix size limitations of the presently available computer program, the eigenvalue equations should be solved out of core in order to handle realistic sources. Author

N78-11799# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.

NOISE CHARACTERISTICS OF EIGHT HELICOPTERS Final Report

H. C. True and E. J. Rickley Jul. 1977 169 p refs (AD-A043842; ARD-550; FAA-RD-77-94) Avail: NTIS HC A08/MF A01 CSCL 20/1

Bell 47G, 206L, and 212 (UHIN), the Hughes 300C and 500C, the Sikorsky S-61 (SH-3B) and S-64 (CH-54B), and the Vertol CH-47C helicopters were tested to determine noise characteristics during level flyovers, simulated approaches, and hover to acquire a data base for possible helicopter noise regulatory action. The acoustic data is presented as an effective perceived noise level, A-weighted sound pressure level and 1/3 octave band sound pressure level with a slow meter characteristic per FAR Part 36. Selected waveforms and narrow band spectra are also shown. Proposed methods to quantify impulsive noise ('blade slap') are evaluated for a level flyover for each of the helicopters. Helicopters with the higher main rotor tip speeds propagate highly impulsive noise ahead of the helicopter. The maximum noise for most of the helicopters occurs near the overhead position and appears to originate from the tail rotor. Unmuffled reciprocating engine helicopters appear to have significant engine noise behind the helicopter. Author

N78-11800# Harry Diamond Labs., Adelphi, Md.

ACOUSTIC DELAY LINE FABRICATION

Stuart I. Lieberman, Owen L. Meyer, Theordore V. Blomquist, and John H. Wasilik Jul. 1977 52 p refs (AD-A043779; HDL-TR-1820) Avail: NTIS HC A04/MF A01 CSCL 20/1

This report describes work performed at the Harry Diamond Laboratories to establish a viable production method for fabricating series-transducer delay lines. The devices considered in this report consist of a crystal delay medium with a series-connected matrix of zinc oxide transducers deposited on each end. This is a new concept (U. S. Patent 3,893,048) which eliminates the need for external electrical matching. Two basic fabrication approaches were tried successfully, and a combination of the two was finally adopted. A step-by-step processing section furnishes complete data regarding the materials, methods, and techniques employed, with sufficient detail to facilitate technology transfer. The devices fabricated operated typically in the bulk wave mode in the 3- to 4-GHz range and displayed through insertion losses of 30 to 50 db for delays in the 0.5-ms region. Some life-time and ruggedness data also are included. Author (GRA)

N78-11801# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.

SOUND TRANSMISSION THROUGH JET ENGINE NOZZLES AND BROADBAND - NOISE AMPLIFICATION BY PURE TONE EXCITATION IN FREE JETS

D. Bechert, E. Pfizenmaier, and U. Michel 1977 14 p refs (DLR-IB-257-77/9) Avail: NTIS HC A02/MF A01

The problem of sound transmission from internal sources in jet engines is discussed. The transmission path for the essential part of sound energy coincides with that of the internal flow downstream to the nozzle exit. Sound then crosses the external free jet flow on its way to the far field, and an interaction takes place between sound from internal sources and the free turbulence within the jet. Possibilities for alternating this broadband amplification are described. ESA

N78-11802# National Gas Turbine Establishment, Pyestock (England).

THE USE OF CO-FLOWING AIRSTREAMS FOR THE SIMULATION OF FLIGHT EFFECTS ON JET NOISE

D. J. Way and B. J. Cocking Jun. 1977 47 p refs (NGTE-R-345; BR58372) Avail: NTIS HC A03/MF A01

The influence of a co-flowing airstream on the noise of subsonic air jets was investigated over a range of secondary-to-primary area ratios from 1.8 to 1800. The simulation consists of surrounding the air jet emitted from a stationary nozzle with a concentric secondary jet blowing at an appreciably lower velocity representing that of flight. Correlations of the data confirm that the effects of flight on jet mixing noise may be investigated using a comparatively small secondary stream and with the microphone positioned outside the flow. Results show that a minimum area ratio of about 50 is necessary to model adequately the effects of flight for the main noise-producing regions of the jet. As the size of the secondary stream is reduced, information for the lower frequencies is progressively lost. Author (ESA)

N78-11803# Bristol Univ. (England). Dept. of Mechanical Engineering.

INVESTIGATION INTO THE NOISE SOURCES IN A PORTABLE DIESEL GENERATOR B.S. Thesis

W. R. Funnell and J. T. Stansfeld Jun. 1977 45 p refs (BU-77/B.2) Avail: NTIS HC A03/MF A01

An analysis of the major noise producing sources is presented. The test program is detailed with regard to recording methods and data processing using third-octave filters to obtain values of sound pressure levels for each frequency band. The noise sources were identified as lying at the exhaust system and the diesel knock associated with combustion. Methods for reducing low and middle frequencies by use of a large resonant silencer, and middle to high frequencies by use of an acoustic enclosure, are described. Problem areas still remain in the engine cooling aspects. ESA

N78-11996# European Space Agency, Paris (France).

ACOUSTIC EMISSION FROM COHERENT STRUCTURES IN A TURBULENT JET

Claude Dahan *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-2 (ESA-TT-408) Sep. 1977 p 123-157 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-2, Mar. - Apr. 1977 p 113-126 Original report in FRENCH previously announced as A77-32947 (For availability see N78-11991 02-99)
Avail: NTIS HC A09/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N78-11804 California Univ., Berkeley.

EXCITED STATE ENERGY TRANSFER STUDIES USING ELECTRON SPIN COHERENCE Ph.D. Thesis

John Conarroe Brock 1976 170 p
Avail: Univ. Microfilms Order No. 77-15617

The use of electron spin coherence techniques for examining the dynamics of excited states subject to energy transfer processes is described. Equations detailing the time evolution of a coherently coupled two-level system are presented and developed to include the effects of feeding and decay processes on coherence induced in an excited state ensemble. Various mechanisms responsible for a loss of phase coherence in an excited state ensemble are identified and discussed, including the effects of energy exchange between systems that are not translationally equivalent. Application of these considerations to several coherence experiments reveals that non-equivalent exchange processes produce a loss of coherence independent of any interactions between the excitation and its environment. Also described is the electron spin ordering, a new approach for examining electronically excited states. Author

N78-11805 Rutgers - The State Univ., New Brunswick, N. J.
AN INVESTIGATION OF COMPOUND NUCLEAR LIFETIMES IN THE PRESENCE OF DIRECT PROCESSES Ph.D. Thesis
Elliot Paul Kanter 1977 150 p
Avail: Univ. Microfilms Order No. 77-17544

The elastic and inelastic scattering of low energy protons on single crystal targets of germanium, molybdenum, and nickel were investigated using the crystal blocking technique of an ultrashort nuclear lifetime measurement. It is demonstrated that the finite lifetime of the compound nucleus is detectable in the elastic channel despite the presence of a large prompt shape elastic scattering contribution. It is shown that these data can be used, together with an analytic calculation of the blocking effect, to experimentally determine the time dependence of the nuclear reactions studied. These measurements provide the first truly reaction-model-independent method of determining the relative importance of direct and delayed processes to the reaction cross section. The extracted compound elastic cross sections are compared with an approximation formula that takes account of the width fluctuation correction to the Hauser-Feshbach formula for compound nuclear cross sections. Dissert. Abstr.

N78-11806 Connecticut Univ., Storrs.
LOW ENERGY ELECTRON-HELIUM TOTAL SCATTERING MEASUREMENTS Ph.D. Thesis
Robert Howard Bullis 1977 297 p
Avail: Univ. Microfilms Order No. 77-16700

A modified Ramsauer beam experiment has been employed to determine the total electron-helium elastic scattering section over the energy range from 0.05 to 3.0 eV. In these measurements a scattering chamber and energy analyzing region has been employed which permits the elimination of unwanted stray electric and magnetic fields, and the effects of contact potentials. The total scattering cross section determined from these measurements has been found to be in excellent agreement with polarized orbital and variational calculations in which the effects of polarization, exchange, and distortion, are included. The total scattering data obtained is also in good agreement with previous beam measurements down to energies of 0.3 eV, and with swarm measurements of the momentum transfer cross section obtained from drift tube experiments. The zero energy scattering length determined from this measurement is 1.145 a sub 0.
Dissert. Abstr.

N78-11807 Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
LIMITS ON THE RADIATIVE DECAY OF NEUTRINOS
R. Cowsik Apr. 1977 10 p refs Submitted for publication
Avail: Issuing Activity

Astronomical observations at the X-ray, optical, and radio frequencies are used to show that the lifetime of neutrinos for radiative decay divided by the rest mass exceeds 10 to the 17th power sec/eV. If the rest mass is assumed to be greater than 0.001 eV, then the lifetime is greater than 10 to the 19th power sec. Author (ESA)

N78-11808*# National Aeronautics and Space Administration, Washington, D. C.
ANALYTICAL REPRESENTATION OF ELASTIC SCATTERING CROSS SECTIONS OF LOW ENERGY ELECTRONS BY ATMOSPHERIC GASES
V. Ye. Ivanov, N. K. Sipov, and V. A. Shneyder Sep. 1977 9 p refs Transl. into ENGLISH from Analiticheskoye Predstavleniye Secheniy Uprugogo Rasseyaniya Elektronov Malykh Energiy atmosfernymi Gazami, Geomagnetism i Aeronomiya (USSR), v. 17, no. 2, 1977 p 242-245 Original Language document was announced as A77-35637 Transl. by Scitran, Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75194) Avail: NTIS HC A02/MF A01 CSCL 20H

Analytical representations of the elastic scattering cross sections of electrons with energies of 0.01-1 keV in atmospheric gases of N2, O2, O are given. These representations are suitable for the Monte Carlo method. Author

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N78-11809 Ohio Univ., Athens.
NEUTRON INELASTIC SCATTERING FROM CLOSED-SHELL NUCLEI Ph.D. Thesis
David Ernest Bainum 1977 257 p
Avail: Univ. Microfilms Order No. 77-16781

Neutron inelastic scattering from the doubly closed-shell nuclei 40Ca and 208Pb and the singly closed-shell nucleus 90Zr was observed. As the excited states observed in these (n,n') reactions were collective in nature, arising mainly from spacially correlated motion of the nucleons which results in vibrational deformations of the nucleus, the macroscopic or collective model for inelastic scattering was used to calculate the shapes of the differential cross section angular distributions with the distorted wave method. The optical potentials obtained by fitting the elastic scattering data were used to provide the distorted waves used in the transition amplitude. The form factor was the radial derivative of the optical potential. By comparing the calculated angular distribution shapes to the data, deformation parameters and lengths were extracted. These values were compared to the corresponding (p,p') measurements to determine if the values were dependent on the isospin of the incident projectile.
Dissert. Abstr.

N78-11810# Central Inst. for Industrial Research, Blindern (Norway).
MATERIALS SCIENCE - HIGH TEMPERATURE MATERIALS [MATERIALVITENSKAP - HOGTEMPERATURMATERIALER]
Per Kofstad 10 Mar. 1976 58 p refs
(Contract NTNF-B-1204.5702)
Avail: NTIS HC A04/MF A01

The main aspects of oxidation and carburization of high temperature alloys exposed in HTR helium atmospheres with impurities of H2, H2O, CO, and CH4 are summarized. The reaction behavior is discussed in terms of the thermodynamics and kinetics of the different oxidation and carburization reactions which may take place, and a tentative reaction mechanism is proposed. The main oxidizing reaction involves oxidation by water vapor, while the main reaction responsible for carburization is tentatively concluded to comprise the reaction between methane and carbon monoxide. On this basis the conditions for achieving minimum materials degradation by oxidation and carburization are discussed both in terms of alloy compositions and the relative amounts of impurities in the helium coolant. Author (ESA)

74 OPTICS

Includes light phenomena.

N78-11811 Purdue Univ., Lafayette, Ind.
SOLAR RADIATION PROPAGATION THROUGH MASS ALGAL CULTURES Ph.D. Thesis
Kenneth John Daniel 1976 249 p
Avail: Univ. Microfilms Order No. 77-15397

The importance of different radiative transfer phenomena on the propagation of radiation in a mass algal culture was studied. Particular attention was devoted to the scattering and absorption processes and to conditions in the visible regions of the spectrum. Different algal species and cultures were considered. The procedures involved measuring the inherent optical properties of the algal cells, using these properties in solutions to the equation of radiative transfer and comparing the solutions with radiation measurements in a laboratory mass culture. The results showed that the spectral distributions of the absorption and extinction cross sections were approximately independent of algal species and culturing conditions. The absorption by a cell tended to follow the absorption bands of chlorophyll, while the extinction

cross section was largely independent of wavelength.
Dissert. Abstr.

N78-11812*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PERFORMANCE ANALYSIS OF GRAZING INCIDENCE IMAGING SYSTEMS
Carl E. Winkler and Dietrich Korsch (Teledyne Brown Engineering, Huntsville, Ala.) Nov. 1977 40 p refs
(NASA-TP-1088; M-241) Avail: NTIS HC A03/MF A01 CSCL 20F

An exact expression relating the coordinates of a point on the incident ray, a point of reflection from an arbitrary surface, and a point on the reflected ray is derived. The exact relation is then specialized for the case of grazing incidence, and first order and third order systematic analyses are carried out for a single reflective surface and then for a combination of two surfaces. The third order treatment yields a complete set of primary aberrations for single element and two element systems. The importance of a judicious choice for a coordinate system in showing field curvature to clearly be the predominant aberration for a two element system is discussed. The validity of the theory is verified through comparisons with the exact ray trace results for the case of the telescope. Author

N78-11813*# Washington Univ., St. Louis, Mo. Dept. of Earth and Planetary Sciences.
IMAGING NATURAL MATERIALS WITH A QUASI-MICROSCOPE Final Report, 1 Jul. 1974 - 31 Aug. 1977
Susan Bragg and Raymond Arvidson 31 Aug. 1977 47 p refs
(Contract NsG-1084)
(NASA-CR-155250) Avail: NTIS HC A03/MF A01 CSCL 20F

A Viking lander camera with auxilliary optics mounted inside the dust post was evaluated to determine its capability for imaging the inorganic properties of granular materials. During mission operations, prepared samples would be delivered to a plate positioned within the camera's field of view and depth of focus. The auxiliary optics would then allow soil samples to be imaged with an 11 pm pixel size in the broad band (high resolution, black and white) mode, and a 33 pm pixel size in the multispectral mode. The equipment will be used to characterize: (1) the size distribution of grains produced by igneous (intrusive and extrusive) processes or by shock metamorphism, (2) the size distribution resulting from crushing, chemical alteration, or by hydraulic or aerodynamic sorting; (3) the shape and degree of grain roundness and surface texture induced by mechanical and chemical alteration; and (4) the mineralogy and chemistry of grains. Author

N78-11814# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
ELECTROOPTIC AND PHOTOREFRACTIVE EFFECTS IN KNbO3 Ph.D. Thesis
Peter Guenter 1976 113 p refs
(ETH-5818) Avail: NTIS HC A06/MF A01

The half-wave voltages, electro-optic (EO) and polarization-optic (PO) coefficients of orthorhombic and tetragonal KNbO3 were evaluated. The temperature dependence of the EO coefficients shows that the PO coefficients are temperature independent in the tetragonal and in the orthorhombic phase respectively. The linear PO effects in both phases are the same quadratic effects biased by the spontaneous polarizations. From the dispersion of the EO coefficients, the quadratic polarization potentials were evaluated and found to be comparable to those determined from band edge shift measurements and to those of other oxygen-octahedra ferroelectrics. Optically induced index changes (light damage) are discussed in terms of photoconductivity results. The notation implied by space group Bmm2 was adopted in labeling the orthorhombic crystal axes. Author

N78-11815# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
INELASTIC LIGHT SCATTERING IN RARE EARTH COMPOUNDS Ph.D. Thesis
Janis Vitins 1976 85 p refs
(ETH-5846) Avail: NTIS HC A05/MF A01

Multiphonon inelastic light scattering was investigated in the magnetically ordering Eu and in the diamagnetic Yb monochalcogenides. All aspects of this scattering suggest that the multiphonon lines result from recombination during time resolved relaxation of the excited 'hot' electron. The multiphonon scattering in these compounds is therefore interpreted by a two-step process of absorption followed by emission (hot luminescence). The observation of zone-center and zone-boundary multiphonon scattering is related to the electron-phonon coupling which is dependent on the kinetic energy of the excited photon-electron. Multiphonon inelastic light scattering has also been observed in the mixed valence compounds Eu3O4 and Eu3S4. In Sm3S4 only electronic Raman scattering could be detected. The temperature dependent valence fluctuations of the latter two compounds are related to a breathing mode within the sulfur sublattice. Author

N78-11816# Rome Air Development Center, Griffiss AFB, N.Y.
REFRACTIVE INDEX CHANGES IN OPTICAL FIBERS SUBJECT TO DIAMETRAL STRESS
Peter D. Gianino and Bernard Bendow Apr. 1977 20 p refs
(AD-A043035; RADC-TR-77-140) Avail: NTIS HC A02/MF A01 CSCL 20/6

The changes in refractive index induced by the photoelastic effect when an optical fiber is subjected to a uniformly applied diametral stress are described. For easily achievable values of the force per unit length applied to the fiber, it was found that regions of equal or higher refractive index than the core may be induced in the outer region of the fiber. Thus the stressed region is capable of acting as a mode converter that affects the transmission characteristics of the fiber. Author (GRA)

N78-11817# California Univ., Irvine. School of Engineering.
IMAGING OF INCOHERENT OBJECTS BY INTENSITY CORRELATION INTERFEROMETRY Final Report, Oct. 1971 - Sep. 1976
Hideya Gamo 31 Jan. 1977 49 p refs
(Grant AF-AFOSR-2155-72)
(AD-A043233) Avail: NTIS HC A03/MF A01 CSCL 20/5

New optical, electronic and information processing techniques for imaging of incoherent objects through fluctuating medium were studied. These techniques are based on the principles of Hanbury Brown-Twiss intensity interferometer and its generalization by the principal investigator. The effect of the fluctuating and scattering medium between incoherent objects and sensors was investigated by using both laboratory simulation and field experiments. The statistics of intensity fluctuation of the laser beam transmitted through both simulated and practical atmosphere were analyzed by the real-time data acquisition system, which consists of PDP 15/20, an analog-to-digital convertor, two digital volt meters and two digital-to-analog convertors.
GRA

N78-11818# Hughes Aircraft Co., Culver City, Calif. Display Products Dept.
DIFFRACTION OPTICS STUDY Final Report, 1 Mar. - 30 Sep. 1976
W. N. Lewis, D. H. Close, L. G. Cook, and R. S. Jacobs Wright-Patterson AFB, Ohio AMRL Jun. 1977 130 p
(Contract F33615-76-C-0508)
(AD-A043632; AMRL-TR-76-119) Avail: NTIS HC A07/MF A01 CSCL 20/6

A study has been conducted to determine the feasibility of extending the information display capability in a modern fighter aircraft through the employment of diffraction optics techniques. Baseline concepts were designed using (1) reflective holographic optical elements on the aircraft canopy and (2) transmissive holographic optical elements on the operator's flight helmet visor. Evaluation of these system's performance by a computer was conducted. State-of-the-art surveys in holographic technology, image sources and materials technology are presented. The impact of future advances in the state of the art on the feasibility of these systems is discussed. Requirements for the extended display technology are formulated, using simulated encounter and mission analysis data. Author (GRA)

N78-11819# Washington Univ., St. Louis, Mo. Lab. for Applied Electronic Sciences.

TIME AND FREQUENCY DEMULTIPLEXING IOC RECEIVERS Progress Report, 1 Jul. 1975 - 20 Apr. 1976
W. S. C. Chang and C. M. Wolfe 29 Apr. 1976 23 p refs (Contract N00014-75-C-1155)
(AD-A043591) Avail: NTIS HC A02/MF A01 CSCL 20/6

The following progress has been made toward the realization of an IOC receiver. (1) GaAs electroabsorption avalanche photodiode (EAP) detectors with responsivities up to 60 A/W have been successfully fabricated in single-mode waveguide structures and evaluated experimentally. (2) The effects of doping, applied voltage, and device dimensions on the performance of EAP waveguide detectors has been evaluated theoretically as an aid to device and system optimization. (3) Using this analysis a three-channel frequency demultiplexing receiver using EAP waveguide detectors has been designed. (4) A three-channel, 1 M bit/sec time demultiplexing system has been designed, constructed, and demonstrated. GRA

N78-11820# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
PRELIMINARY STEPS IN THE DESIGN OF OPTICAL CHARACTER RECOGNITION
Robert J. Shillman and Robert T. Babcock 1977 7 p refs (Contract DAAB07-76-C-1400; Grant NSF ENG-74-24344)
(AD-A043900) Avail: NTIS HC A02/MF A01 CSCL 06/4

Previous publications have described a theory and techniques for designing optical character recognition algorithms using psychophysical methodology, focusing on the methodology used to determine Physical to Functional Rules (PFRs). The present paper describes important preliminary steps that precede the psychological experiments, including the choice of an appropriate letter pair for study, the formation of a hypothesis regarding relevant attributes that distinguish the letters of the pair, and the design of stimuli for the subsequent psychophysical experiments. These steps are described in the context of the problem of designing an algorithm for recognizing handprinted 2's from handprinted Z's. Author (GRA)

N78-11989# European Space Agency, Paris (France).
CAST COMPOSITE MIRRORS FOR INFRARED RADIATIONS
Marie-Paule Lemaitre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-1 (ESA-TT-407) Sep. 1977 p 99-133 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-1, Jan.-Feb. 1977 p 49-61 Original report in FRENCH previously announced as A77-27744 (For availability see N78-11984 02-99)
Avail: NTIS HC A07/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N78-11821 California Univ., Berkeley.
MEASUREMENT OF THE COLLISIONAL TRANSITION RATES BETWEEN METASTABLE AND HIGHER ENERGY STATES IN PARTIALLY IONIZED HELIUM Ph.D. Thesis
Robert Olds Hagerty 1976 61 p
Avail: Univ. Microfilms Order No. 77-15706

Cylindrical electrostatic probes were used to measure the electron temperature and density in an induction heated supersonic jet of partially ionized helium in which the metastable atoms were undergoing a net rare of excitation to higher states. Spectroscopic emission and absorption measurements were used to determine the densities of excited states with principal quantum numbers n less than or = 2. The investigations were carried out over a range of electron temperatures from 0.35 to 0.77 eV and an electron density of about 10 to the 13th power/cu cm. The net rate of n=2 to n=3 excitation was obtained for seven experimental conditions from a balance of the production and depletion rates for the n=3 states. Dissert. Abstr.

N78-11822 California Univ., Los Angeles.
EFFECTS OF FINITE PUMP BANDWIDTH ON THE PARAMETRIC-DECAY INSTABILITY Ph.D. Thesis
Stephen Philip Obenschain 1977 122 p
Avail: Univ. Microfilms Order No. 77-16194

The capability of finite pump bandwidth to control parametric instability in a plasma was investigated. Parametric decay instability was excited electrostatically by means of grids immersed in a low density plasma to determine the effects of finite pump bandwidth on the threshold power, growth, saturation level, and spectral structure of the instability produced plasma waves. As the pump bandwidth approached and exceeded the instability resonance width, the instability was inhibited. The effects of finite pump bandwidth on the production of nonthermal hot electrons by parametric instability excited by high critical density plasma were also studied. With sufficient pump bandwidth, the hot electron production is reduced or eliminated. Dissert. Abstr.

N78-11823 California Univ., Berkeley.
STABILIZATION OF INTERCHANGE MODES IN A MULTIPLE MIRROR PLASMA Ph.D. Thesis
John Charles Riordan 1976 108 p
Avail: Univ. Microfilms Order No. 77-15835

Interchange instabilities in a plasma confined by a periodic magnetic mirror field theoretically stabilized by a minimum-average-B well created by superposing a quadrupole filed upon the mirror field. The arbitrary magnetic field was expanded to fourth power in radius and the depth and radial extent of the well were calculated. Variational and heuristic techniques were used to determine field shapes which optimize various well parameters. A simple, realistic coil geometry is given for a minimum-average-B well applicable to multiple mirror fusion reactors. The stabilization of interchange modes was investigated with a thermal lithium plasma confined by a periodic magnetic mirror field with adjustable curvature. As the destabilizing curvature was reduced, the transverse velocity of the m = 1 mode was observed to decrease substantially. The stabilization was greater than that predicted by curvature reduction alone; an explanation in terms of line-typing is presented. Dissert. Abstr.

N78-11824 California Univ., Berkeley.
EXPERIMENTAL STUDY OF CONFINEMENT AND STABILITY OF A HIGH DENSITY PLASMA IN A MULTIPLE MIRROR MAGNETIC FIELD CONFIGURATION Ph.D. Thesis
Michel Tuszewski 1976 193 p
Avail: Univ. Microfilms Order No. 77-15892

Multiple mirror magnetic confinement is investigated experimentally with a 10eV, 10 to the 13th power per cu cm hydrogen plasma produced by a theta pinch source. Partial plasma stability was achieved with a linked quadrupole field which also enhanced radial losses. A theory was developed for the classical radial losses. Its results, inserted in a numerical simulation of the experiment, agreed quantitatively with the observed losses. Dissert. Abstr.

N78-11825# Nagoya Univ. (Japan). Inst. of Plasma Physics.
SOLITONS, ENVELOPE SOLITONS IN COLLISIONLESS PLASMAS
Yoshi H. Ichikawa and S. Watanabe Aug. 1977 48 p refs (IPPJ-298) Avail: NTIS HC A03/MF A01

Theoretical, computational and experimental studies of nonlinear wave propagation in collisionless plasmas are reviewed. The historical experiment of Ikezi et al. is discussed in comparison with theoretical analysis based on the Korteweg-de Vries equation. Systematic discrepancy between the observation and the theoretical prediction suggests that it is necessary to examine such as higher order mode coupling effect and contribution of trapped particles. Effects of the nonlinear Landau damping on the envelope soliton of the ion plasma wave is reviewed. A new type of evolution equation derived for the Alfven wave is examined in some detail. The rigorous solution obtained for this mode represents a new kind of envelope soliton, in which both of its phase and amplitude are subject to modulation of comparable spatial extension. Author

N78-11826# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ELECTRON HEATING AND ANOMALOUS TRANSPORT IN THE INITIAL STAGE OF TURBULENT HEATING OF A PLASMA
H. Iguchi Aug. 1977 40 p refs
(IPPJ-299) Avail: NTIS HC A03/MF A01

Thompson scattering of ruby laser light was used to investigate the initial stage of turbulent plasma heating. In a low density discharge, an anomalously rapid electron heating was observed associated with the appearance of high frequency fluctuations which were considered to be current driven ion acoustic waves. The formulation of flat-top velocity distribution of the electrons just after the onset of the ion acoustic instability was interpreted as a quasilinear diffusion process in velocity space in the presence of ion acoustic waves. In a high density discharge, the skin current distribution was rapidly destroyed, while skin profile of the radial distribution of the electron temperature remained longer, indicating that the plasma current was redistributed without electron heat transfer across the magnetic field. Author

N78-11827# Nagoya Univ. (Japan). Inst. of Plasma Physics.
THEORY FOR STATIONARY NONLINEAR WAVE PROPAGATION IN COMPLEX MAGNETIC GEOMETRY
T. Watanabe, H. Hojo (Hiroshima Univ., Japan), and Kyoji Nishikawa (Hiroshima Univ., Japan) Aug. 1977 30 p refs
(IPPJ-300) Avail: NTIS HC A03/MF A01

A method was developed for calculating nonlinear wave propagation in the self-consistent plasma profile in complex magnetic-field geometry. Basic assumptions and/or approximations include use of the collisionless two-fluid model with an equation of state restriction to a steady state propagation, and existence of modified magnetic surface, with modification due to Coriolis' force. Situations studied are: (1) weak-field propagation without static flow; (2) arbitrary field strength with flow in axisymmetric system; (3) weak field limit of case 2; and 4 arbitrary field strength in nonaxisymmetric torus. Except for case 3, a simple variation principle was derived by introducing appropriate coordinates. In cases 1 and 3, explicit results for quasilinear profile modification were obtained. Author

N78-11828# Nagoya Univ. (Japan). Inst. of Plasma Physics.
THRESHOLD OF ELECTROMAGNETIC INSTABILITY IN A MAGNETIC NEUTRAL SHEET
Kaoru Yamanaka Aug. 1977 40 p refs
(IPPJ-301) Avail: NTIS HC A03/MF A01

The structure of electromagnetic perturbations in a magnetic neutral sheet was analyzed within the framework of a Vlasov-Maxwellian picture. In reference to the Harris equilibrium state, a boundary value problem was formulated and solved to give the possible existence of a low-frequency electromagnetic wave of compressional mode, propagating along the electron-drift current in the sheet. The stability of this mode is critically dependent on the thickness parameter of the sheet. If the sheet is thin enough, the perturbation will grow even for T sub e = T sub i. The critical thicknesses were calculated with regard to various temperature ratios and their values were found to be about 0.9 r(*) sub Li or less, where r(*) sub Li means the ion Larmor radius just outside the sheet region. Author

N78-11829# Nagoya Univ. (Japan). Inst. of Plasma Physics.
CURRENT DRIVEN INSTABILITY IN BOTH SELF-INDUCED AND EXTERNAL MAGNETIC SHEAR FIELD
Sanae Inoue, Kimitaka Itoh, and Shoichi Yoshikawa Aug. 1977 14 p refs
(IPPJ-302) Avail: NTIS HC A02/MF A01

The current-driven universal drift instability in a self-consistent magnetic shear field was analyzed. A novel and simple method to determine the eigen value of the model was developed. It is found that even in a fairly strong shear residual, modes remain unstable in the presence of the parallel current. The confinement scaling law for high field Tokamaks was obtained. Author

N78-11830# Nagoya Univ. (Japan). Inst. of Plasma Physics.
SHEAR STABILIZATION OF COLLISIONAL DRIFT INSTABILITY
Sanae Inoue, Kimitaka Itoh, and Shoichi Yoshikawa Aug. 1977 14 p refs
(IPPJ-303) Avail: NTIS HC A02/MF A01

Using the normal mode expansion method, the collisional drift waves of the slab plasma in the sheared magnetic field were investigated. In the strong shear parameter regime, the growth rate is found to be proportional to the square root of the electron collision frequency/omega sub *. The diffusion coefficient is also estimated and the density limitation of the high density Tokamak is shown. Author

N78-11831# JAYCOR, Del Mar, Calif.
PLASMA PHYSICS MECHANISMS RELEVANT TO STRIATION STRUCTURING AND DECAY. PART 1: ASPECTS OF STRIATION DECAY. PART 2: A SYNOPSIS OF DRIFT MODE BEHAVIOR. PART 3: VELOCITY SHEAR, THE E x B INSTABILITY AND THE K TO THE -2ND POWER DENSITY SPECTRUM Final Report, 22 Dec. 1975 - 21 Dec. 1976
S. Robert Goldman 1 Feb. 1977 85 p refs
(Contract DNA001-76-C-0186)
(AD-A043571; J77-75014-FR; DNA-4245T) Avail: NTIS HC A05/MF A01 CSCL 20/9

The purpose of this report is to present various factors affecting striation decay as well as to indicate their significance in terms of possible time scales for striation decay and spatial structuring of striations. In the second section mechanisms affecting sinking of ionization both parallel and perpendicular to B are presented and time scales estimated. In the third section diffusion due to one type of plasma turbulence is presented as well as ordinary collisional diffusion. Some aspects of the interplay of diffusion with spatial structure and striation evolution are shown. These are used to assess the dependence of decay on diffusion coefficient as well as to infer the possibility of plasma turbulence diffusion in observational situations. In the fourth section our results are summarized both as to decay and spatial structuring of striations. GRA

N78-11832# Boston Coll., Chestnut Hill, Mass.
MICROINSTABILITIES IN COMPLEX MAGNETIC FIELD GEOMETRIES AND HIGH-BETA SHEARED SHEATH STRUCTURE Progress Report, 1 Mar. 1976 - 28 Feb. 1977
Pradip Bakshi and Gabor Kalman Feb. 1977 20 p refs
(Contract EY-76-S-02-2714)
(COO-2714-3) Avail: NTIS HC A02/MF A01

An approach for the solution of the Vlasov equation for complex magnetic field geometries and for the determination of ensuing stability criteria for microinstabilities was developed. Various parameters were estimated in the contexts of Tokamak and tormac regimes, by carrying out analytically the averaging over the fast cyclotron motion to obtain a compact expression for the dispersion equation, and by considering the ensuing results for stability of the drift wave in various parameter domains. High-beta, high shear plasma sheath structures were studied both analytically and through computation work. Results in the Vlasov-fluid model for simple ion distribution functions indicate a relation for maximum shear that the sheath can support for a given beta. The effect of the rotation of the main plasma on the sheath structure, the coupling of the main plasma to the sheath and its rotational damping, and the formation of a viscous boundary layer between the sheath and the plasma were investigated. ERA

N78-11833# Johns Hopkins Univ., Baltimore, Md.
EXTREME ULTRAVIOLET AND SOFT X-RAY DIAGNOSTICS OF HIGH-TEMPERATURE PLASMAS Annual Progress Report, 1 Jun. 1976-31 May 1977
H. W. Moos, L. Armstrong, Jr., and W. G. Fastie 1977 67 p refs
(Contract EY-76-S-02-2711)
(COO-2711-2) Avail: NTIS HC A04/MF A01

Four areas of research are discussed: (1) diagnostic studies of magnetically confined high temperature plasmas, (2) supporting laboratory studies, (3) theoretical studies of highly ionized atoms, and (4) instrument development are discussed. Spatially resolved ultraviolet measurements on Elmo Bumpy Torus have determined impurity confinement times. The measured oxygen densities and fluxes are being determined at Alcator; the spectroscopic studies show that hydrogen discharges in this Tokamak have an effective Z close to one. A laboratory study of the Penning discharge between 100 and 300 A shows that it is a bright source for evaluation of EUV diagnostic instrumentation. Design of a multispatial element spectrometer system is complete and construction has begun. Computer programs needed for relativistic calculation of transition probabilities and wavelengths have

been completed and applied to calculations in the Li, Be, Ar, and K isoelectronic sequences. ERA

N78-11834# Los Alamos Scientific Lab., N. Mex.
ENGINEERING FEASIBILITY EVALUATION OF A PERISTALTIC PINCH
G. P. Biocourt Apr. 1977 7 p refs
(Contract W-7405-eng-36)
(LA-6766-MS) Avail: NTIS HC A02/MF A01

A recent proposal for reducing the end loss of a linear theta pinch is to produce moving magnetic mirrors at the coil ends. The concept entails the sequential pulsing of an axially arranged series of two-turn coaxial coils. The individual pulse circuits must be interconnected through isolating inductors to enable the production of a uniform biasing magnetic field. Moreover, the coils must be located physically close together. This produces strong magnetic coupling between the pulse circuits, which can seriously affect the shape and speed of the inward-moving magnetic-mirror field. Possible systems were modeled for the NET-2 circuit analysis code. The results show that an increasing magnetic mirror can be produced provided the radius of the theta pinch is not too great compared to the intercoil spacing. The peristaltic field can be maintained for several cycles in the inner coils. The voltage hold-off requirements on the pulse circuit switches are found to be severe, but not impossible to meet. ERA

N78-11835# Princeton Univ., N. J. Plasma Physics Lab.
ION HEATING IN ATC TOKAMAK IN THE ION CYCLOTRON RANGE OF FREQUENCIES
H. Takahashi, C. C. Daughney, R. A. Ellis, Jr., R. J. Goldston, H. Hsuan, T. Nagashima (Japan Atomic Energy Res. Inst, Tokai), F. J. Paoloni, A. J. Sivo, and S. Suckewer Mar. 1977 14 p refs
(Contract EY-76-C-02-3073)
(PPPL-1332) Avail: NTIS HC A02/MF A01

Ion heating by irradiation of rf fields in the ion cyclotron range of frequencies was investigated using several diagnostic techniques. It is shown that substantial heating of the bulk of the ions can be achieved by this method. ERA

N78-11836# Princeton Univ., N. J. Plasma Physics Lab.
HEATING TOKAMAKS VIA THE ION-CYCLOTRON AND ION-ION HYBRID RESONANCES
F. W. Perkins Apr. 1977 77 p refs
(Contract EY-76-C-02-3073)
(PPPL-1336) Avail: NTIS HC A05/MF A01

For the ion-ion hybrid resonance it is shown that: (1) the energy absorption occurs via a sequence of mode conversions; (2) a poloidal field component normal to the ion-ion hybrid model conversion surface strongly influences the mode conversion process so that roughly equal electron and ion heating occurs in the present proton-deuterium experiments, while solely electron heating is predicted to prevail in deuterium-tritium reactors; (3) the ion-ion hybrid resonance suppresses toroidal eigenmodes; (4) wave absorption in minority fundamental ion-cyclotron heating experiments will be dominated by ion-ion hybrid mode conversion absorption for minority concentrations exceeding roughly 1 percent. For the ion-cyclotron resonance, it is shown that: (1) ion-cyclotron model conversion leads to surface electron heating; and (2) ion-cyclotron mode conversion absorption dominates fundamental ion-cyclotron absorption thereby preventing efficient ion heating. ERA

N78-11837# Princeton Univ., N. J. Plasma Physics Lab.
BISTABLE EQUILIBRIUM OF TOKAMAK AND ITS APPLICATION TO MAGNETIC PUMPING
H. Hsuan and K. Bol Mar. 1977 15 p refs
(Contract EY-76-C-02-3073)
(PPPL-1341) Avail: NTIS HC A02/MF A01

The creation of bistable equilibria with respect to major radius of a Tokamak plasma, and multiple cycles of fast compression and expansion of the plasma ring during transitions between the equilibrium positions were demonstrated. Results of experiments with the ATC Tokamak are presented. The transition through the unstable region was an order of magnitude faster than for a normal adiabatic compression, and had a duration comparable to the ion-ion collision time for the ATC plasma. The principle of the Furth-Ellis proposal for implementing the Artsimovich axisymmetric magnetic pumping scheme was demonstrated. ERA

N78-11838# Princeton Univ., N. J. Plasma Physics Lab.
MONTE CARLO ALGORITHM FOR CALCULATING NEUTRAL GAS TRANSPORT IN PLASMAS
M. H. Hughes and D. E. Post Mar. 1977 24 p refs
(Contract EY-76-C-02-3073)
(PPPL-1335) Avail: NTIS HC A02/MF A01

A Monte Carlo treatment of neutral gas transport is described. The model is implemented in a code which is sufficiently fast and compact to be incorporated as part of a radial diffusion code. Models for backscattering and sputtering at surfaces are included as options. ERA

N78-11839# Princeton Univ., N. J. Plasma Physics Lab.
CALCULATIONS OF IMPURITY RADIATION AND ITS EFFECTS ON TOKAMAK EXPERIMENTS
R. V. Jensen, D. E. Post, W. H. Grasberger, C. B. Tarter, and W. A. Lokke Mar. 1977 30 p refs
(Contract EY-76-C-02-3073)
(PPPL-1334) Avail: NTIS HC A03/MF A01

The impurity radiation for typical Tokamak parameters was numerically calculated using an average-ion model. Coronal equilibrium values for the emission of oxygen, iron, molybdenum, tungsten and gold were determined from the steady-state solutions of a set of related rate equations which included the effects of electron collisional ionization and excitation, dielectronic and radiative recombination, delta = 0 and delta not equal to 0 line transitions, and bremsstrahlung. The results for oxygen and iron compare very well with other calculations. The detailed steady-state emission rates were used to investigate the effects of various concentrations of impurities on the n/sub e/tau requirements for breakeven, ignition, and Q = 5 beam driven reactor experiments. ERA

N78-11840# Uppsala Univ. (Sweden).
ELECTRON ENERGY DISTRIBUTION IN A HIGH PRESSURE GAS DISCHARGE SUSTAINED BY A HIGH CURRENT ELECTRON BEAM
M. B. Tendler Sep. 1976 22 p
(UPTEC-7669) Avail: NTIS (US sales only) HC A02/MF A01; ERDA Depository Libraries

Electron energy distribution was calculated for the electron energies strongly exceeding the ionization energy. The consideration is valid also for the non-uniform local distribution in velocity space. An approximate analytical solution was carried out, and the expression for the integrated distribution function is given. Using this function the number of ionizations was calculated assuming three-body recombinations as the main loss mechanism. The specific energy deposited in the gas mixture was calculated compared with experimental results. The agreement is found to be reasonable. ERA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N78-11841 Massachusetts Univ., Amherst.
OPTICAL MODULATION AND ADSORPTION IN PROTON IRRADIATED GALLIUM ARSENIDE Ph.D. Thesis
Moshe Oren 1977 172 p
Avail: Univ. Microfilms Order No. 77-15105

Band-to-band electroreflectance, electroabsorption, and transmission measurements were used to study the effect of proton bombardment on high resistivity, Cr doped, single crystal GaAs irradiated with 150 KeV proton beam at doses up to 10 to the 17th power protons/sq cm. Shifts, broadening, and gradual distortion of the spectral peaks were observed as disorder increased with successive bombardment. The decay of the electromodulation signals upon successive bombardment indicates the gradual relaxation in the long range order until total amorphization is achieved when the electroreflectance and electroabsorption signals completely disappear. A model based

on the gradual amorphization of the sample by an increasing number of proton-damaged amorphous islands with well defined boundaries is presented to explain the experimental results. Dissert. Abstr.

N78-11842 Columbia Univ., New York.
PHOTON ECHO MODULATION AND PHOTON ECHO RELAXATION IN RUBY Ph.D. Thesis
Sheldon Meth 1977 158 p
Avail: Univ. Microfilms Order No. 77-14830

Using ground and excited state parameters measured by spin and photon echo ENDOR, the two pulse photon echo modulation was calculated for the E(2E)(-1/2) to 4A2(-1/2) transition in ruby for off axis magnetic fields. This modulation was measured with an improved gated CW ruby laser system. The experimental results agree quite well with theoretical calculations, which use a Hamiltonian generalized to include an asymmetry and tilt of the gradient of the electric field tensor at the aluminum nuclear site. The results do not agree well with a simpler Hamiltonian which uses the ground state parameters from standard ENDOR and approximate excited state parameters. Dissert. Abstr.

N78-11843 Brown Univ., Providence, R. I.
ELECTRON-ELECTRON INTERACTIONS IN THE INVERSION LAYER OF A METAL-INSULATOR-SEMICONDUCTOR STRUCTURE Ph.D. Thesis
Ting-Kuo Lee 1976 100 p
Avail: Univ. Microfilms Order No. 77-14153

The Landau-Silin theory of an electron liquid was applied to a two-dimensional system in the inversion layer of a metal-insulator-semiconductor structure. The electric polarizability and magnetic susceptibility are evaluated in the presence of a dc magnetic field. The magnetoplasma modes are investigated for both very short and very long wavelengths. A sequence of 'cyclotron harmonic' waves were found. In addition to the cyclotron harmonic modes, the usual two-dimensional plasmon was found. For very large values of q, the cyclotron mode which begins at omega = I alpha I omega sub e approaches asymptotically to the value omega = (I-1) omega sub c. Here alpha sub I is the phenomenological Fermi-liquid constant. The Landau interaction function is evaluated microscopically. The values of the effective mass and the q-factor are computed.Dissert. Abstr.

N78-11844# Polish Academy of Sciences, Warsaw.
PEIERLS STRESS IN A TWO-DIMENSIONAL MODEL OF SCREW DISLOCATION [NAPIECIE PEIERLSAW PLASKIM MODELU DYSLOKACJI SRUBOWEJ]
Romual Kotowski 31 Jan. 1977 112 p refs In POLISH
Avail: Issuing Activity

A model of screw dislocation is examined which is: a) infinite, b) completely discrete (as opposed to the Peierls-Nabarro model, which contains elastic half-spaces as continuous elements), c) two-dimensional (as opposed to the one-dimensional model of Frenkel-Kontorova and Sanders). As a crystal lattice, we take an isometric simple lattice. A cross-section of the isometric lattice yields a quadratic lattice. Translocation of atoms is permitted only in a direction perpendicular to the plane of the cross-section. The work is divided into three sections. Part 1 presents a concise description of several models of dislocation in which an attempt is made to estimate Peierls stress. Part 2 contains a description of the proposed model --an adaptation of the dynamic model of screw dislocation proposed by Rogula. Part 3 presents the results of studies of Peierls stress in the Gamma function. Final results are presented in graphic form. A supplement contains a block program used in calculation on the CDC CYBER 72 electronic computer. Author

N78-11845 Iowa State Univ. of Science and Technology, Ames.
MAGNETIC BEHAVIOR OF CURRENT-CARRYING TYPE-2 SUPERCONDUCTING CYLINDERS Ph.D. Thesis
Michael Lawrence Silber 1977 284 p
Avail: Univ. Microfilms Order No. 77-16976

The complex magnetic behavior of current-carrying superconducting cylinders in the presence of applied axial fields was systematized by accounting for critical current, surface pinning, and surface pitch angle, and by stressing the importance of the magnetic history of the sample. A differential equation relating the thermo-dynamic field to the cylinder radius was developed and integrated numerically. The resultant flux profiles were further integrated to obtain the mean magnetization of the cylinder. A phase-diagrammatic technique shows the relative amounts of axial and aximuthal field needed to produce a given field within the cylinder. A pair of simultaneous differential equations was developed, and simultaneously integrated to yield a flux profile which accounts for any arbitrary variations in the current and axial field experience by the sample in progressing from the virgin state to the final flux configuration. Dissert. Abstr.

N78-11846 North Carolina Univ., Chapel Hill.
A THEORETICAL STUDY OF SUPERIONIC CONDUCTORS: BETA ALUMINA AND RUBIDIUM SILVER IODINE Ph.D. Thesis
Takao Takeuchi 1976 100 p
Avail: Univ. Microfilms Order No. 77-17375

The so-called spin restricted self-consistent-field multiple-scattered-wave method in the muffin-tin approximation was used to determine the characteristic differences in electronic energy levels and charge density distributions in sodium beta alumina and silver beta alumina. The possibility of the existence of covalency between an Ag+ ion and O2- ions in silver beta alumina is discussed. The potential energy curves of an Ag+ ion in rubidium silver iodide were obtained using Ewald coulomb energy, Born-Mayer repulsive energy, and polarization energy, including 125 unit cells. Fundamental lattice frequencies obtained using these curves are compared to the observed Raman frequencies and frequencies calculated from thermal parameters. An attempt is made to account for non-uniform distribution of Ag+ ions over available sites. Dissert. Abstr.

N78-11847 Ohio Univ., Athens.
SUPERCONDUCTIVITY AND SPECIFIC HEAT MEASUREMENTS IN V-Nb-Ta TERNARY ALLOYS Ph.D. Thesis
Robert Yung-Pon Wang 1977 125 p
Avail: Univ. Microfilms Order No. 77-16786

The correlation between the superconducting transition temperature with electronic specific heat coefficient and Debye temperature in some isoelectronic ternary V-Nb-Ta alloys was investigated. Samples were obtained by arc casting high purity starting materials in a pure argon atmosphere on a water-cooled copper hearth with samples being turned over to improve homogeneity. The Green-Culbert technique of specific heat measurement was used in collecting the experimental data. Superconducting transition temperature, electronic specific heat coefficient, and Debye temperature all increase nearly monotonically by 5%, 30%, and 8% respectively with alloying away from Ta toward V25Nb75, indicating that influence of V-Nb (and V-Ta) on the ternary alloy properties is far greater than that of Nb-Ta. A model that takes into account the variation of properties caused by possible charge transfer among constituent atoms in an alloy is discussed. Dissert. Abstr.

N78-11848 New York Univ., N. Y.
FORBIDDEN RESONANT RAMAN SCATTERING AND SPECTROSCOPY IN THE YELLOW EXCITON SERIES OF CUPROUS OXIDE Ph.D. Thesis
Morris Allen Washington 1976 214 p
Avail: Univ. Microfilms Order No. 77-16533

Normally forbidden first order Raman scattering from odd parity phonons was observed as a cw dye laser was tuned through the yellow exciton series of cuprous oxide only when the frequency of the incident or scattered radiation was within a few wave-numbers of a dipole forbidden exciton state. The dependence of the forbidden scattering on the frequency and polarization of the radiation field as well as the dependence on the wave vector of the phonon and photon were investigated to characterize the intermediate exciton states involved in the Raman scattering processes and their interactions with the crystal lattice and the radiation field. From the frequency and polarization dependence of the forbidden scattering from odd parity phonons in the excited states, the energies, widths, and symmetries of a number of quadrupole-allowed exciton states were determined. Dissert. Abstr.

N78-11849 New Mexico Univ., Albuquerque.
THE EFFECTS OF RADIATION ON THE INTERFACE STATE DENSITY OF MOS TRANSISTORS Ph.D. Thesis

Jan Eugene Whitefield 1976 280 p
Avail: Univ. Microfilms Order No. 77-16127

The results indicate that interface state density (Nss) in the mid gap range increases with total gamma radiation dose. Curiously, Nss at the band edges can either increase or decrease. This seems to imply that the origin of the interface states is multi faceted, and more than one origin or mechanism gives rise to Nss at the band edge. In the mid gap region, but only one mechanism seems to dominate. Possible explanations of this behavior are presented in terms of a dangling bond model and an oxygen deficiency model. For the conditions where the device is strongly turned on, the mobility is rather insensitive to radiation. However, near the device turn-on point, the mobility is strongly affected by radiation. It is felt that radiation exposure generates scattering centers in the semiconductor which decrease the effective mobility. Finally, the conclusion is reached that the mid gap states seem most important in determining MOSFET performance. Dissert. Abstr.

N78-11850 Florida Univ., Gainesville.
APW CALCULATION OF THE ELECTRON-PHONON INTERACTION IN SOLID ARGON AND NEON Ph.D. Thesis
Joseph Patrick Worth 1976 93 p
Avail: Univ. Microfilms Order No. 77-17069

The electron-phonon interaction in solid argon and neon was calculated within the self-consistent field Augmented Plane Wave local exchange (APW-X alpha) model. Second order perturbation theory involving the calculated Electron-Phonon Matrix Element (EPME) was used to compute corrections to phonons unperturbed by the electron-phonon interaction. The unperturbed phonons were calculated within the self-consistent harmonic approximation, assuming a superposition of Lennard-Jones pair potentials. Explicit expressions for the EPME were derived in the APW formalism, as were selection rules between representations involved in the relevant inter-band transitions. The perturbed phonons, calculated as a test of the EMPME, were found to be in poor agreement for neon and in good agreement for argon, a distinction which can be traced directly to the shortcomings in the original X alpha calculation on neon. Dissert. Abstr.

N78-11851*# National Aeronautics and Space Administration, Washington, D. C.
QUESTIONS OF THE ANALYSIS OF MILLIMETER-WAVE FREQUENCY CONVERTERS ON DIODES WITH A SCHOTTKY BARRIER
G. S. Bordonskiy Oct. 1977 85 p refs Transl. into ENGLISH from Academy of Sci. USSR, Inst. of Space Res. Report PR-322, 1977 p 1-40 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75049; PR-322) Avail: NTIS HC A05/MF A01 CSCL 20L

Millimeter-wave frequency converters on a diode with a Schottky barrier were analyzed. The analysis includes investigation of the effect of the variable capacitance of the diode's elements on the frequency converters. Specifically, the transmission, impedance, and noise characteristics of the frequency converters were examined. Author

N78-11852*# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
SECONDARY ELECTRON EMISSION FROM A DIELECTRIC FILM SUBJECTED TO AN ELECTRIC FIELD M.S. Thesis
Nguyen Quoc-Nguyen Nov. 1977 87 p refs
(Grant NsG-3097)
(NASA-CR-155231) Avail: NTIS HC A05/MF A01 CSCL 20L

An electric field in the range of [0,3,3,3] kV/mm is created normal to a thin film FEP teflon sample which accumulates potential of up to 8.8, 13.7 or 18.3 kV when exposed to an electron beam having energy of 10.0, 15.0 or 20.0 kV, respectively. It is found that the secondary electron emission from the charged sample varies with field. The threshold voltage, at which the secondary electron emission coefficient sigma is unity, drops down from a low field value of 13.73 kV to a high field value of 13.11 kV for a 15.0 kV beam. A computational technique was developed that generates equipotential lines or contours and field vectors above a plane where potential is known. The utilization of conformal transformations allows the extension of the technique to configurations which map into a plane. Author

N78-11853# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
POSITRON LIFETIME IN SILVER BROMIDE Ph.D. Thesis [LEBENSOAUER DER POSITRONEN IN SILBERBROMID]
Karl Heinz Surbeck 1976 31 p refs In GERMAN; ENGLISH summary
(ETH-5823) Avail: NTIS HC A03/MF A01

Measurements of positron lifetime in AgBr crystals grown by different techniques are presented. The time spectra for annealed samples are analyzed in the frame of a 'two-state' model which takes into account the polarization by the positron's charge and the contribution from the silver d-shell electrons. From mass spectrographic analysis and from the influence of doping or illumination on the positron lifetime it is concluded that the transition rate cannot be attributed to trapping of positron at cation vacancies. However, a systematic correlation between the mean lifetime and the occurrence of the molecular ions AgBr+ and Br2+ was noted in the mass spectrographic studies. Mechanical treatment of samples is shown to have a large effect on positron lifetime. A third component of approx. 650 ps appears in deformed crystals and is attributed to positrons trapped at dislocations. Author

N78-11854# Hughes Research Labs., Malibu, Calif.
INDIUM PHOSPHIDE FOR MICROWAVE GUNN DEVICES Interim Report, Jun. 1976 - Jun. 1977
Lewis Fraas and Kenneth Zanio Jun. 1977 30 p refs
(Contract F44620-76-C-0133)
(AD-A043128; AFOSR-77-0944TR) Avail: NTIS HC A03/MF A01 CSCL 09/1

One-micron-thick films of InP were epitaxially deposited onto single-crystal InP substrates at about 400 C by the planar reactive deposition technique. Scanning electron microscope measurements show that smooth surfaces are obtained on (100) substrates, and shingled surfaces are obtained on (III) substrates. Mass spectrographic analysis indicates that the purity of these films is about 10 parts per million atomic. Electrical evaluation of these films deposited on semi-insulating substrates shows that at room temperature the films are n-type with electron concentrations as low as 10 to the 16th power/cu cm and mobilities as high as 1350 sq cm/V sec. Author (GRA)

N78-11855# Ballistic Research Labs., Aberdeen Proving Ground, Md.
X ALPHA CALCULATION OF TRANSITION ENERGIES IN MULTIPLY IONIZED ATOMS
D. A. Ringers Jul. 1977 16 p refs
(AD-A043091; BRL-MR-2766) Avail: NTIS HC A02/MF A01 CSCL 20/8

The X alpha method has been applied to the calculation of ionization energies in multiply ionized atoms. It is shown that the accuracy of calculations can be improved if appropriate (different) values of alpha are used for each configuration. Alternatively, one can use the Slater transition state, wherein a total energy difference is related to a difference in single-electron eigenvalues. By a series expansion, the value of alpha for an excited configuration can be related to its value for the ground-state configuration. The terms Delta alpha(deleE/del/alpha), thus introduced, exhibit a similar dependence on atomic number as the ground-state values of alpha. Results of sample calculations are reported and compared with experiment.
Author (GRA)

N78-11856# Colorado State Univ., Fort Collins. Dept. of Physics.
ELECTRONIC PROPERTIES OF III-V SEMICONDUCTOR INTERFACIAL LAYERS Annual Report, 15 Jun. 1976 - 14 Jun. 1977
James R. Sites, Larry G. Meiners, and Hudson A. Washburn 1 Jul. 1977 19 p refs
(Contract N00014-76-C-0976)
(AD-A043250; SF12) Avail: NTIS HC A02/MF A01 CSCL 20/12

Results have been obtained on the use of neutralized ion beam sputtering of Si3N4 on GaAs for MIS applications and on classical and quantum electrical transport in InAs epilayers.
Author (GRA)

N78-11857# Princeton Univ., N. J. Dept. of Civil and Geological Engineering.
SCREW DISLOCATION IN NONLOCAL HEXAGONAL ELASTIC CRYSTALS
A. Cemal Eringen and F. Balta Jul. 1977 32 p refs
(Contract N00014-76-C-0240)
(AD-A043454; Rept-77-SM-12) Avail: NTIS HC A03/MF A01 CSCL 20/11

The solution is given for the problem of screw dislocation in hexagonal crystals with long range interatomic interactions. The field equations of nonlocal elastic solids are employed to determine the anti-plane shear stresses and the elastic energy for a screw dislocation in the basal plane. Interestingly enough, none of the classical stress and energy singularities are present in the nonlocal solutions. Maximum shear stresses are calculated for several hexagonal crystals and compared with the isotropic materials. Theoretical shear stress to initiate a dislocation with a Burger's vector of one atomic distance is calculated and found to be in the acceptable range known from the lattice dynamic calculations. Author (GRA)

N78-11858# Argonne National Lab., Ill.
NEUTRON INELASTIC SCATTERING FROM LIQUID HELIUM-3
K. Skold and C. A. Pelizzari 1977 22 p refs Presented at Symp. on Quantum Fluids and Solids, Sanibel Island, Fla., 24 Jan. 1977
(Contract W-31-109-eng-38)
(CONF-770122-1) Avail: NTIS HC A02/MF A01

Results of neutron inelastic scattering studies of liquid 3 He at 15 mK have been reported previously. These results are summarized in the present paper which also contains some additional data obtained at smaller wave-vectors. It is shown that for q less than or approximately equal to 1.4 per A the zero-sound mode and the spin-fluctuation spectrum are observed as separate peaks in the scattering function. For q greater than or approximately equal to 2 per A strong evidence is obtained for sharp two-phonon scatter at approximately twice the energy of the flat portion of the zero-sound dispersion curve. ERA

N78-11859# Los Alamos Scientific Lab., N. Mex.
STABILIZATION OF SHORT-WAVELENGTH DISTURBANCES IN THE RAYLEIGH-TAYLOR INSTABILITY OF PLASTIC SOLIDS BY A SURFACE LAYER OF HIGH YIELD STRENGTH
R. C. Mjolsness Mar. 1977 17 p refs
(Contract W-7405-eng-36)
(LA-6744-MS) Avail: NTIS HC A02/MF A01

The mechanical effects of a thin surface layer in reducing the growth of the Rayleigh-Taylor instability of a plastic solid plate is investigated by representing the surface layer as an elastic plate of high yield strength and high bonding strength to the plastic. This plate may be either the surface layer itself or a composite material formed by interactions of the surface layer with the solid surface layers. In this approximation it is found under wide ranges of conditions that short-wavelength disturbances are stabilized in linear approximation. In this limit the 'gravitational' energy increment of the displaced plastic solid is overcome by the elastic shear energy of the stretched plate. Long-wavelength disturbances are very weakly affected by this mechanism. For a plastic plate of approximately 1-cm thickness subjected to a pressure difference of approximately 100 kbar we expect wavelengths shorter than lambda/sub c/ approximately. ERA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N78-11860# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
ON THE QUANTUM THEORY FOR DOMAIN WALLS Ph.D. Thesis [ZUR QUANTENTHEORIE VON DOMAENENWAENDEN]
Rolf Schilling 1976 67 p refs In GERMAN; ENGLISH summary
(ETH-5851) Avail: NTIS HC A04/MF A01

For a 180 deg domain wall in a Heisenberg ferromagnet, the Hamiltonian containing exchange, anisotropy, and boundary interaction terms was treated quantum-mechanically. This leads to results which differ qualitatively from those of classical studies in which the spins are considered as vectors with fixed length S. A complete system of eigenstates exists for which the transverse magnetization vanishes. Selecting the eigenstates using further symmetry of the Hamiltonian leads in some cases to the spin operator equaling zero in the middle layer of the wall. For a one dimensional chain with spin S= 1/2 the properties of the ground state were investigated. The influence of the dipole-dipole-interaction on the spin structure was also studied. Author

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N78-11861*+ National Aeronautics and Space Administration, Washington, D. C.
RESEARCH AND TECHNOLOGY OBJECTIVES AND PLANS. SUMMARY Research and Technology Program, FY 1978
1977 126 p
(NASA-TM-78623) Avail: NTIS HC E02 CSCL 05A

The NASA Research and Technology program for FY 1978 is represented by this compilation of the 'Summary' portions of each of the Research and Technology Objectives and Plans (RTOPS). The RTOP Summary is designed to facilitate communication and coordination among concerned technical personnel in government, in industry, and in universities. The first section contains citations and abstracts of the RTOPs. Following this section are four indexes: Subject, Technical Monitor, Responsible NASA Organization, and RTOP Number. Author

N78-11862# Duke Univ., Durham, N. C. Graduate School of Business Administration.
DECISION PROCESS MODELS OF PEER NOMINATIONS
Arie Y. Lewin 30 Jun. 1977 121 p
(Contract N00014-76-C-0007)
(AD-A043062; TR-2) Avail: NTIS HC A06/MF A01 CSCL 05/11

The objective of this research project is to develop an information processing theory of the judgemental process individuals engage in, while rating their peers. The complete research paradigm is described in Lewin and Zwany (1976). The approach taken was to utilize protocol tracing methods to

construct decision process models of how individuals rate their peers for seven widely used sociometric questions: (1) Who would you go to for help on a tough problem; (2) Who is pulling most for the group; (3) Who was best at handling people; (4) Who has the most ability to think critically and analytically; (5) With whom can you work best; (6) Who shows the greatest independence of thought; and (7) Who shows the best overall leadership qualities. The protocols revealed that individuals evaluated their peers along five primary behavior categories - (1) mutual influence, (2) categorizing-summarizing, (3) having a comprehensive view, (4) giving direction, and (5) listening. The detailed protocols were then used to develop a scoring method of videotaped group interactions which included content scoring of the verbal interactions and the non-verbal behavior (i.e. head nodding, eye contact, openness, etc.). GRA

N78-11863# Stanford Research Inst., Menlo Park, Calif.
PRELIMINARY ASSESSMENT FOR DESIGNING EXPERIMENTS USING FEDERAL INNOVATION PROCESSES
Charles Williams, Egils Milbergs, and Robert Quick Apr. 1977 303 p
(Contract NSF C-828)
(PB-270089/6; CSSP-4676-14; NSF/RA-770121) Avail: NTIS HC A14/MF A01 CSCL 05A

The groundwork for a practical approach for systemically monitoring and evaluating naturally occurring federal innovation processes was established. A natural experimental approach that potentially can provide a cost effective strategy for evaluating the impact of alternative federal technology incentives was studied. The frameworks presented provide a set of tools to help evaluators to begin to describe the federal innovation process for individual cases and the components that affect each case. GRA

N78-11864# International Institute for Applied Systems Analysis, Laxenburg (Austria).
MULTI-ORGANIZATIONAL STRATEGIES: AN ANALYTIC FRAMEWORK AND CASE ILLUSTRATIONS
Cyril Davies, Ada Demb, Raul Espejo, and Roman Ostrowski Feb. 1977 33 p refs
(IIASA-RM-77-4) Avail: NTIS HC A03/MF A01

An analytical framework to support organizational strategies for the planning and management of multi-sectoral programs is presented. Two different case studies are reported. The first is concerned with the 'Impacts of Oil Development Offshore of the Northeast Coast of Scotland'. While some findings specific to Scotland are presented, stress is laid on conveying the methodology developed to study the orgranizational dimension of large development programs. This methodology is used in the second case study, the 'Bratsk-Ilimsk Territorial Production Complex', to analyze a particular policy issue presently under consideration by Soviet policy makers, namely, the need for new management mechanisms to support the present evolution of territorial production complexes. Author (ESA)

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N78-11865* + National Aeronautics and Space Administration, Washington, D. C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SECTION 2: INDEXES SUPPLEMENT 11
Jul. 1977 555 p
(NASA-SP-7039(11)) Avail: NTIS HC E06 CSCL 05B

This continuing bibliography lists indexes for 3256 patents and patent applications introduced into the NASA scientific and technical informations system from January 1977 through June 1977. The index section contains five indexes: subject, inventor, source, number, and accession number. Author

N78-11866# Federation of Rocky Mountain States, Inc., Denver, Colo.
USER NEEDS ASSESSMENT FOR AN OPERATIONAL GEOGRAPHIC INFORMATION SYSTEM: REGION 6, U. S. FISH AND WILDLIFE SERVICE
Larry Salmen, George Nez, Carl Reed, John Hamill, and James Gropper Jun. 1977 112 p Sponsored in part by EPA
(Contract DI-14-16-0008-2155)
(PB-269274/7; FWS/OBS-77/21) Avail: NTIS HC A06/MF A01 CSCL 05B

A five month survey of user needs for a geographic information systems within region six of the U.S. Fish and Wildlife Service (FWS) is documented. This task focused on the assessment of three groups of users: (1) the Denver region six offices of FWS; (2) the Billings area office within region six; and (3) the office of Biological Services Special Projects. Some twenty individual user offices were interviewed with structured questionnaires and follow-up sessions to identify their legislative mandates, programs, tasks, work elements, and specific spatial data needs. GRA

N78-11867# Federation of Rocky Mountain States, Inc., Denver, Colo.
A GENERAL DESIGN SCHEMA FOR AN OPERATIONAL GEOGRAPHIC INFORMATION SYSTEM: REGION SIX, U.S. FISH AND WILDLIFE SERVICE
Larry Salmen, George Nez, Carl Reed, John Hamill, and James Gropper Jun. 1977 50 p Sponsored in part by EPA
(Contract DI-14-16-0008-2155)
(PB-269275/4; FWS/OBS-77/22) Avail: NTIS HC A03/MF A02 CSCL 05B

A general system design is presented, and a basic set of system capabilities is outlined for a proposed U.S. Fish and Wildlife Geographic Information System. The system is to operate at two levels. One is a manual system for cataloging maps, revelant articles, and other paper documents. The second level is the automated level. At the automated level, a computer based information system will allow for data input, data analysis, and information output based on user specified criteria. GRA

N78-11868# George Washington Univ. Medical Center, Washington, D.C.
PRELIMINARY REPORT OF THE PROVIDERS PERSPECTIVE CONFERENCE OF THE NATIONAL FORUM ON SCIENTIFIC AND TECHNICAL COMMUNICATION
Feb. 1977 44 p Presented at Providers Perspective Conf. (Winter), Calif. Academy of Sci., 18 Feb. 1977
(Contract NSF C-743)
(PB-269058/4; GWU-SCD-77/2) Avail: NTIS HC A03/MF A01 CSCL 05B

Problems and issues encountered in adequately meeting the needs of scientific and technical information users are addressed. The viewpoints and perceptions of professional librarians, publishers, information specialists, and educators are reported. GRA

N78-11869# George Washington Univ. Medical Center, Washington, D.C.
PRELIMINARY REPORT OF THE USER'S PERSPECTIVE CONFERENCE OF THE NATIONAL FORUM ON SCIENTIFIC AND TECHNICAL COMMUNICATION
Nov. 1976 41 p Presented at Users Perspective Conf. (Fall) Boston Museum of Sci., 11 Nov. 1976
(Contract NSF C-743)
(PB-269057/6; GWU-SCD-77/1) Avail: NTIS HC A03/MF A01 CSCL 05B

Existing availability and utilization of scientific and technical information was assessed by professionals from public and private organizations, public interest groups, and the press. Problems contributing to inadequate service to users are discussed. GRA

N78-11870# Center for Naval Analyses, Arlington, Va.
ERROR DETECTION IN COMPUTERIZED INFORMATION RETRIEVAL DATA BASES
Russell C. Coile Jul. 1977 18 p refs
(AD-A043580; CNA-Professional-Paper-189) Avail: NTIS HC A02/MF A01 CSCL 05/2

The introduction of on-line interactive literature searching systems in recent years has made it possible for information

scientists to conduct bibliometric studies which might have been difficult or impractical to do by manual methods. The unconventional uses of on-line information retrieval systems are becoming more common as we learn how to search using non-subject information fields. Author's name, organizational affiliation, journal's name, year of publication, etc., can now be searched for easily. However, sometimes there are problems. It would seem worthwhile for those responsible for management of these mechanized information storage and retrieval data bases to attempt to use all economically feasible error-detecting and correcting schemes to reduce the error rate as much as practicable. Several suggestions for detecting errors are examined. GRA

N78-11871# National Commission on New Technological Uses of Copyrighted Works, Washington, D. C.
TRANSCRIPT OF CONTU MEETING, 15TH
Jul. 1977 276 p Conf. held at Wash. D.C., 11-12 Jul. 1977 (PB-271326/1; CONTU-77-0007) Avail: NTIS HC A13/MF A01 CSCL 05B

Testimony was presented on economics of property rights as applied to computer software and data bases; on economics of property rights; on copyright for computer data bases and software; on the economics of interlibrary loans and at what point it becomes more economical to subscribe than to photocopy; on the CONTU sponsored study into the attitudes and practices of journal publishers on authorized photocopying; and on an analysis of computer and photocopying copyright issues from the point of view of the general public and ultimate consumer. GRA

N78-11872# Harry Diamond Labs., Adelphi, Md.
USER'S MANUAL FOR THE MODULAR ANALYSIS-PACKAGE LIBRARIES ANAPAC AND TRANL
Thomas V. Noon and Egon Marx Sep. 1977 23 p refs (DA Proj. 1W1-62118-AH-75) (AD-A044845; HDL-TR-1782-S) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report is a supplement to the user's manual for the ANAPAC and TRANL libraries (HDL-TR-1782) and reflects the conversion of these libraries from a CDC computer to the HDL IBM 370/168 computer. Only presented are those modifications which affect the usage of previously presented software routines and new software routines added since the publication of the original user's manual. The usage of those software routines on the HDL IBM computer not discussed in this report is unaffected. Author (GRA)

N78-11873# Advisory Group for Aerospace Research and Development, Paris (France).
THE IMPACT OF FUTURE DEVELOPMENTS IN COMMUNICATIONS, INFORMATION TECHNOLOGY AND NATIONAL POLICIES ON THE WORK OF THE AEROSPACE INFORMATION SPECIALIST
Sep. 1977 86 p refs Presented at the Technol. Inform. Panel Specialists' Meeting, Oslo, 22-23 Jun. 1977 (AGARD-CP-225; ISBN-92-835-1254-5) Avail: NTIS HC A05/MF A01

The main trends in communications and information technology were identified; the purpose was to assess the impact of these trends on the information specialist, and to consider what other developments might be desirable, particularly in relation to aerospace scientific and technical information. For individual titles, see N78-11874 through N78-11888.

N78-11874# Norwegian Center for Informatics, Oslo.
THE NORWEGIAN-SCANDINAVIAN SCIENTIFIC AND TECHNICAL INFORMATION SCENE
A. Disch *In* AGARD The Impact of Future Develop. in Commun., Inform. Technol. and Natl. Policies on the Work of the Aerospace Inform. Specialist Sep. 1977 4 p refs (For availability see N78-11873 02-82)
Avail: NTIS HC A05/MF A01

Norwegian technical information users were surveyed to assess their knowledge of present information channels and their preference and utilization of various information systems. Cooperative efforts have been undertaken by Sweden, Norway, Denmark, Finland, and Iceland to promote the organization of Scandinavian technical documents. J.H.

N78-11875# Norwegian Defence Research Establishment, Kjeller.
THE SMALL NATIONS' NEEDS FOR SCIENTIFIC AND TECHNICAL INFORMATION: THE CASE OF NORWAY
Finn Lied *In* AGARD The Impact of Future Develop. in Commun., Inform. Technol. and Natl. Policies on the Work of the Aerospace Inform. Specialist Sep. 1977 5 p refs (For availability see N78-11873 02-82)
Avail: NTIS HC A05/MF A01

The needs of small nations for scientific and technical information are considered, focusing on technical research in Norway; political goals and technical strengths of a country such as Norway are among the factors considered. Also reviewed is the organization of Norwegian research and development, including funding mechanisms for such programs. J.H.

N78-11876# Norwegian Center for Informatics, Oslo.
INFORMATION 1990: A NORWEGIAN SCENARIO
Hans K. Krog *In* AGARD The Impact of Future Develop. in Commun., Inform. Technol. and Natl. Policies on the Work of the Aerospace Inform. Specialist Sep. 1977 4 p refs (For availability see N78-11873 02-82)
Avail: NTIS HC A05/MF A01

The Norwegian Centre for Informatics conducted a comprehensive study of the possible realistic developments in the field of scientific and technical information in Norway up to the year 1990. The major break-through will be in the extended use of computer on-line terminals, accessing external and internal data bases and data banks providing not only bits and pieces of information, but indeed also adding computer power to the handling and manipulation of these data directly from the office. Electronic publication will be in its early stages making an impact especially in the scientifically advanced areas of basic and applied research breaking down further the geographical boundaries and the time delay obstacles to the free flow of information. More time and money will be spent on information for the purpose of making better decisions and keeping abreast of the current developments in science and in business. The leadtime in technological development will consequently be reduced. In the information field more emphasis will be put on the quality of information and data accessible, both in content and in presentation. Graphic information and illustrations will be part of the content in data bases and data banks. Confidence limits and other quality stamps will be an integral part of the information provided. Author

N78-11877# Dansk Teknisk Oplysningstjeneste, Copenhagen.
SCANNET - EURONET: AIMS, POLICIES ORGANIZATION, SERVICES AND IMPACT EXPECTED
Kjeld Klintoe *In* AGARD The Impact of Future Develop. in Commun., Inform. Technol. and Natl. Policies on the Work of the Aerospace Inform. Specialist Sep. 1977 7 p refs (For availability see N78-11873 02-82)
Avail: NTIS HC A05/MF A01

Two European information and documentation networks, SCANNET (within the Scandinavian countries) and EURONET (an EEC cooperative), are assessed, evaluating systems administration, communications and equipment, and services' contributions to local political goals. Both systems comprise national 'access points' linked by telecommunication lines, data bases stored on host computers, and a widely distributed group of terminal users. Strategies for effective systems management are suggested. J.H.

N78-11878# Gesellschaft Deutscher Chemiker, Weinheim (West Germany).
THE FUTURE OF PRIMARY SCIENTIFIC PUBLICATIONS
Helmut Gruenewald *In* AGARD The Impact of Future Develop. in Commun., Inform. Technol. and Natl. Policies on the Work of the Aerospace Inform. Specialist Sep. 1977 2 p (For availability see N78-11873 02-82)
Avail: NTIS HC A05/MF A01

In order to overcome difficulties of primary literature and to improve and accelerate the flow of scientific information, an integrated publication system is proposed, whereby full papers are published in microform only. For each paper entering the microform store a synopsis of about one printed page is published in the classical way, i.e. in a synopsis journal. Papers will continue to be refereed before they are accepted for publication. Microform

is offered to libraries for subscription, since it is impractical and undesirable for several resaons to establish 'manuscript banks' or 'depositary libraries'. Such institutions would impede rather than enhance the flow of information. Author

N78-11879# Capital Systems Group, Rockville, Md.
INNOVATIONS IN INFORMATION TRANSFER: A PROGRAM TO STIMULATE CHANGE
William A. Creager *In* AGARD The Impact of Future Develop. in Commun., Inform. Technol. and Natl. Policies on the Work of the Aerospace Inform. Specialist Sep. 1977 11 p refs (For availability see N78-11873 02-82)
(Contract NSF C-950)
Avail: NTIS HC A05/MF A01

A program to stimulate the introduction of beneficial change into the scientific and technical communication process has been operating for three years. Concentrating initially on the primary dissemination component of the communication process, a guidebook for innovators was produced and distributed. Various activities to expand the guidebook, encourage the utilization of its contents, and evaluate its usefulness were then undertaken. The program experience and results to date are discussed, and plans for expanding the program into other areas of the scientific and technical information communication process are outlined. Author

N78-11880# Hatfield Polytechnic (England).
PROSPECTS FOR FACSIMILE IN INFORMATION TRANSFER
R. Barrett *In* AGARD The Impact of Future Develop. in Commun., Inform. Technol. and Natl. Policies on the Work of the Aerospace Inform. Specialist Sep. 1977 10 p refs (For availability see N78-11873 02-82)
Avail: NTIS HC A05/MF A01

FACSIMILE was originally used primarily to transmit graphical images but the recent growth of information generation and dissemination has increased its potential. FACSIMILE is now playing an increasingly important role in information transfer generally because of its accuracy, convenience and low labour requirements. Although the majority of machines in operation are 3 - 6 minute analogue devices, machines capable of processing the information digitally in such a way that it can be transmitted in one minute or less are now on the market and the general introduction of such machines at an economic price will greatly increase the use of FACSIMILE. In the United States computer switched FACSIMILE networks using store-and-forward techniques are becoming available, which will eventually allow a mix of packet switched data and FACSIMILE. In addition to providing a general point-topoint FACSIMILE service, such a network would have the capability to translate FACSIMILE transmissions between networks of incompatible machines. Further developments in the store-and-forward field will allow the recording of FACSIMILE information in buffer stores, with later transmission to automatically called receivers using cheap night communication rates. These developments are reviewed and the prospects for FACSIMILE in information transfer systems are considered. Author

N78-11881# Bell Telephone Labs., Inc., Murray Hill, N. J.
THE LIBRARY IN THE FUTURE
W. Kenneth Lowry *In* AGARD The Impact of Future Develop. in Commun., Inform. Technol. and Natl. Policies on the Work of the Aerospace Inform. Specialist Sep. 1977 4 p refs (For availability see N78-11873 02-82)
Avail: NTIS HC A05/MF A01

Current information access patterns will be influenced greatly by new technological developments and by new perceptions of the information requirements of users. Libraries will assume new roles and perform new functions if they are to become more than archives of recorded knowledge. The library of the future will be an active communication device or it will wither and be essentially a warehouse operation. There will be a need for better management control of library operations through system analysis and feedback techniques. Library cooperative efforts using networking arrangements will proceed slowly in specific areas of library operations. These and other matters concerning future library systems and services are discussed. Author

N78-11882# International Translations Centre, Delft (Netherlands).
FROM ETC TO ITC, THE INTERNATIONAL TRANSLATIONS CENTRE
D. VanBergeijk *In* AGARD The Impact of Future Develop. in Commun., Inform. Technol. and Natl. Policies on the Work of the Aerospace Inform. Specialist Sep. 1977 4 p refs (For availability see N78-11873 02-82)
Avail: NTIS HC A05/MF A01

The participation of a greater number of countries of the world in the further development of science and technology will probably make the language barrier stronger instead of weaker. In many cases the scientists of these countries will not use international languages for the communication of their research results. Translating by computer may be the solution for the future. However, human translating, possibly machine-aided, will still be the most effective tool now. International co-operation is needed to make optimal use of existing scientific translations. For this purpose the International Translations Centre (formerly the European Translations Centre) was founded in 1960. Possibilities for future expansion and international co-operation are suggested for the near future and on a long term basis. Author

N78-11883# Defense Documentation Center, Alexandria, Va.
ASSESSMENTS OF DEFENSE INFORMATION AND DOCUMENTATION NEEDS
Hubert E. Sauter *In* AGARD The Impact of Future Develop. in Commun., Inform. Technol. and Natl. Policies on the Work of the Aerospace Inform. Specialist Sep. 1977 8 p refs (For availability see N78-11873 02-82)
Avail: NTIS HC A05/MF A01

Historically, the Defense Documentation Center (DDC) has been and still is, a traditional document and bibliography oriented activity. It is responsible for providing the appropriate data and documentation to increase the effectiveness of scientists, engineers, and others within the Department of Defense and its contractor organizations, who manage by far, the largest portion of the U.S. Government's budget for the research, development, test and evaluation program. However, it was realized within the past few years that the scope of the Center is too narrow to continue satisfying its user population in today's research and development community. As a consequence, formal studies were conducted to synthesize the predictions of user requirements, as well as the forecasts and trends in information technology, into a set of realistic, well-conceived and documented technical objectives for DDC programs in the next decade. Author

N78-11884# Commission of the European Communities, Luxembourg.
DATA BASE SHARING IN THE EURONET ENVIRONMENT
G. W. P. Davies *In* AGARD The Impact of Future Develop. in Commun., Inform. Technol. and Natl. Policies on the Work of the Aerospace Inform. Specialist Sep. 1977 5 p (For availability see N78-11873 02-82)
Avail: NTIS HC A05/MF A01

The EURONET information and documentation network is now in its implementation phase. Detailed preparations are underway to offer users on-line access to some 100 different data bases on over 20 host computers via EURONET. This paper reviews the achievements to date and work in progress is reviewed, including the general design features and installation of the telecommunications network, data base developments, a proposed common command language, and multilingual aspects. A provisional list of data bases to be made accessible through EURONET is presented, together with the names of the host computers on which they will be mounted. This assessment also reviews key principles and policies defining the framework within which EURONET services will operate and identifies factors affecting the sale of data base services. Author

N78-11885# National Scientific and Technical Information Bureau, Paris (France).
THE NATIONAL SCIENTIFIC AND TECHNICAL INFORMATION BUREAU
J. Michel *In* AGARD The Impact of Future Develop. in Commun., Inform. Technol. and Natl. Policies on the Work of the Aerospace Inform. Specialist Sep. 1977 2 p (For availability see N78-11873 02-82)

Avail: NTIS HC A05/MF A01

The Bureau National de L'Information Scientifique et Technique (BNIST) has established a French national network of scientific and technological information, divided into specialized realms; a policy of computerized information has been instituted. BNIST has taken part in the creation of data banks, the training of users, and research in the field of information science technology. The agency also coordinates efforts to disseminate news of scientific and technological advances to the general public. J.H.

N78-11886# IDW, Frankfurt (West Germany).
TWO YEARS EXPERIENCE WITH AN INTEGRATED NATIONAL SCIENTIFIC AND TECHNICAL INFORMATION PROGRAMME
M. Cremer *In* AGARD The Impact of Future Develop. in Commun. Inform. Technol. and Natl. Policies on the Work of the Aerospace Inform. Specialist Sep. 1977 2 p (For availability see N78-11873 02-82)
Avail: NTIS HC A05/MF A01

Problems of implementing a German federal information policy are recounted. Viewing information not only as a raw material but as a product or commodity brings economic factors into play. New technologies enabling the storage of more and more information put a national or international system into direct competition with the commercial interests of printing, publishing, and mass media. Problems such as these are considered in view of present European and worldwide information dissemination networks. J.H.

N78-11887# British Library, London (England). Dept. of Research and Development.
UK DEVELOPMENTS IN SCIENTIFIC AND TECHNICAL INFORMATION
John Gray *In* AGARD The Impact of Future Develop. in Commun., Inform. Technol. and Natl. Policies on the Work of the Aerospace Inform. Specialist Sep. 1977 5 p (For availability see N78-11873 02-82)
Avail: NTIS HC A05/MF A01

The most important UK developments over the last twenty years are reviewed. They relate to libraries as well as information services, and the paper demonstrates the extent to which decisions on development have been related to research. Many of the developments described are coordinated or stimulated by the new British Library. Special attention is given to the growth of library and information systems and networks, to literature back-up services and reviews of needs for further developments. Author

N78-11888# Illinois Univ., Urbana. School of Library Science.
PAPERLESS COMMUNICATION SYSTEMS: PUTTING IT ALL TOGETHER
F. W. Lancaster *In* AGARD The Impact of Future Develop. in Commun., Inform. Technol. and Natl. Policies on the Work of the Aerospace Inform. Specialist Sep. 1977 4 p refs (For availability see N78-11873 02-82)
Avail: NTIS HC A05/MF A01

Advances in computer science and in communications technology allow us to conceive of a global system in which reports of scientific discovery and technological development are composed, published, disseminated and used in a completely electronic mode. In a largely electronic world, the individual scientist will use an on-line terminal to collect notes, to compose reports, to build information files, to search data bases, and to converse with other individuals. A scenario for an information system of the year 2000 is suggested in this report, and mention is made of some technological and intellectual achievements that contribute to make the electronic system entirely possible. Author

N78-11150*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Data Systems Section.
CONFIGURATION CONTROL AND AUDIT ASSEMBLY
A. P. Irvine *In its* The Deep Space Network 15 Oct. 1977 p 166-171 (For availability see N78-11132 02-12)
Avail: NTIS HC A11/MF A01 CSCL 05B

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N78-11889*# Scientific Translation Service, Santa Barbara, Calif.
RESEARCH ON BATTERY-OPERATED ELECTRIC ROAD VEHICLES
V. S. Varpetian Oct. 1977 21 p refs Transl. into ENGLISH from Izv. Akad. Nauk Arm. SSR, Sor. Tekhn. Nauk (USSR), v. 29, no. 2, 1976 p 43-50 Originial language document was announced as A77-21701
(Contract NASw-2791)
(NASA-TM-75142) Avail: NTIS HC A02/MF A01 CSCL 13F

Mathematical analysis of battery-operated electric vehicles is presented. Attention is focused on assessing the influence of the battery on the mechanical and dynamical characteristics of dc electric motors with series and parallel excitation, as well as on evaluating the influence of the excitation mode and speed control system on the performance of the battery. The superiority of series excitation over parallel excitation with respect to vehicle performance is demonstrated. It is also shown that pulsed control of the electric motor, as compared to potentiometric control, provides a more effective use of the battery and decreases the cost of recharging. Author

N78-11890*# ECON, Inc., San Jose, Calif.
THE BENEFITS OF IMPROVED TECHNOLOGIES IN AGRICULTURAL AVIATION
Keith Lietzke, Philip Abram, Chris Braen, Sandy Givens, George A. Hazelrigg, Jr., Robert Fish, Fred Clyne, and Francis Sand Jul. 1977 247 p refs
(Contract NASw-2781)
(NASA-CR-156838) Avail: NTIS HC A11/MF A01 CSCL 02C

The results are present for a study of the economic benefits attributed to a variety of potential technological improvements in agricultural aviation. Part 1 gives a general description of the ag-air industry and discusses the information used in the data base to estimate the potential benefits from technological improvements. Part 2 presents the benefit estimates and provides a quantitative basis for the estimates in each area study. Part 3 is a bibliography of references relating to this study. Author

N78-11891# Little (Arthur D.), Inc., Cambridge, Mass.
INDUSTRIAL PERCEPTIONS OF TECHNOLOGY OPPORTUNITIES AND RELEVANT BASIC RESEARCH Final Report

Michael Michaelis May 1977 101 p
(Grant NSF PRM-77-08335)
(PB-269178/0; ADL-C-80365-F) Avail: NTIS HC A06/MF A01 CSCL 05C

A technique that would illuminate the linkages between current technological opportunities in industry and the areas of science fundamental to technological feasibility was developed and pilot tested. GRA

N78-11892# California Univ., Los Angeles. School of Architecture and Urban Planning.
EUROPEAN DEVELOPMENTS IN THE RECOVERY OF ENERGY AND MATERIALS FROM MUNICIPAL SOLID WASTE Final Report
David W. Conn May 1977 53 p refs
(Contract EPA-5-03-4502)
(PB-270219/9; EPA-600/7-77-040) Avail: NTIS HC A04/MF A01 CSCL 13B

Energy and materials recovery from municipal solid waste in Western Europe and the United States were examined and compared. Specific topics studied include: (1) the use of refuse as a supplementary fuel; (2) pyrolysis; and (3) resource recovery. Solid waste/energy processes in Europe (both existing and under development) that appear to offer potential advantages over processes currently employed in the United States. Systems involving household sorting and separate collection, front-end materials/fuel separation, the burning of refuse derived fuel in electricity generating plants and cement kilns, pyrolysis, incineration with heat recovery, and materials recovery from post-incinerator residues are discussed. Results are summarized. GRA

N78-11893# Harvard Univ., Cambridge, Mass. Landscape Architecture Research Office.
MANAGING SUBURBAN GROWTH: A MODELING APPROACH
Carl H. Steinitz, James Brown, and Peter Goodale 1977 62 p
(Grant NSF EVN-72-03372-A06)
(PB-270113/4; NSF/RA-770119) Avail: NTIS HC A04/MF A01 CSCL 13B

Tools for managing the rapid growth of suburban areas and a system for analyzing the effectiveness and consequences of planning strategies were developed. The pressures and consequences of suburban growth are described in a system of computer models. The individual models are operated separately to address a specific task, or linked to respond to more complex questions beyond the scope of any single model. The models exchange information through a shared computer programming system and a common data base. GRA

N78-11894# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ALTERNATIVE CONCEPTS FOR UNDERGROUND RAPID TRANSIT SYSTEMS, EXECUTIVE SUMMARY Final Report
Bain Dayman, Jr., Ronald C. Heft, Donald W. Kurtz, Ted W. Macie, and John A. Stalkamp Mar. 1977 38 p
(Contract DOT-AS-60019)
(PB-270102/7; DOT-TST-77-31) Avail: NTIS HC A03/MF A01 CSCL 13B

Construction costs and operating energy requirements of future high-performance underground rail mass-rapid-transit systems were investigated. The alternative design approaches studied include: gravity assist; over/under and short stations; various subway train propulsion configurations; and optimized operational control policies. Comparisons were made of several system designs for a specific route and patronage structure. These comparisons indicate that it is practical to significantly reduce construction costs and operational energy requirements of modern underground systems while improving service by incorporating alternative concepts. GRA

N78-11895# Central Inst. for Industrial Research, Blindern (Norway).
METAL-CONTAINING SLUDGE Final Report [METALLHOLDING SLAM]
Aksel Jebens 28 Feb. 1975 39 p In NORWEGIAN; ENGLISH summary
(Contract NTNF-B-1520.3833)
Avail: NTIS HC A03/MF A01

The potential recovery of copper, nickel, cadmium, and zinc from metal hydroxide sludge is discussed with a view to conserving resources and reducing pollution. The economics of the recovery process are related to the value of the metal. ESA

N78-11896# International Institute for Applied Systems Analysis, Laxenburg (Austria).
TECHNOLOGY ASSESSMENT IN A DIALECTIC KEY
Giandomenico Majone Jan. 1977 37 p refs
(IIASA-PP-77-1) Avail: NTIS HC A03/MF A01

Technology and institutions interact dialectically. Institutional factors affect the range of alternatives considered by innovators, the resolution of disputes over the consequences of innovation, and even the efficiency of technical projects. Thus, technological impacts are determined in the arena of institutional choice just as much as in the laboratory and on the drawing board. Examples from the fields of medical care, nuclear power generation, and broadcasting technology are used to illustrate this interdependence. Dialectic thinking, in the Greek sense of a systematic critique of assumptions, arguments, and conclusions, is necessary to counteract institutional and conceptual biases and to support unconventional approaches. As the current interest in adversary proceedings and other dialectic modes of discourse shows, the narrow paradigm of decitionism is being replaced by quasi-jurisprudential methods for assessing the adequacy of arguments, the strength of evidence, and the intrinsic limitations of technical solutions. Author (ESA)

N78-11897# Battelle Inst., Frankfurt am Main (West Germany). Abt. Innovationsforschung.
SCENARIOS FOR CHEMICAL TECHNOLOGY Final Report
Goetz R. Schaude, Harald Legler, and Alexander Schuster-Wolff Bonn Bundesmin. fuer Forsch. u. Technol. Jun. 1977 266 p refs In GERMAN; ENGLISH summary Prepared jointly with Dornier-System and Inst. fuer Systemtech. u. Innovationsforsch.
(Contract BMFT-CVA-1125)
(BMFT-FB-T-77-01) Avail: NTIS HC A12/MF A01

The scenario writing technique was used for the first time as a planning tool for the preparation of the 'Chemical Technology' special research program within the basic program, 'Research and development into the technological means to conserve the supply of raw materials'. Five different scenarios were written with different sets of assumptions in order to outline the alternative situations of the chemical industry (West Germany) in the year 2000 and their effect on the raw materials supply. By using the scenario writing technique it was possible to take into consideration the important surrounding areas, i.e., raw materials markets, trends in economy, energy supply, and environment, to integrate existing forecasts and to obtain within a reasonably short time results that were suitable for practical use. The evaluation of the scenarios resulted in the definition of the problem areas which could be used as guidelines for further R and D sponsoring. Author (ESA)

N78-11898# Mackintosh Consultants, Darmstadt aa
MARKET SURVEY OF SEMICONDUCTORS Final Report
Ian M. Mackintosh, Dieter Diegel, Arthur Brown, and Carl S. denBrinker Bonn Bundesmin. fuer Forsch. u. Technol. Jun. 1977 47 p In GERMAN; ENGLISH summary
(Contract BMFT-NT-682)
(BMFT-FB-T-77-02) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 9,90

Summaries presented include: examination of technology and product trends over the range of current and future products in integrated circuits and optoelectronic displays; analysis and forecast of major economic influences that affect the production costs of integrated circuits and optoelectronic displays; forecast of the applications and markets for integrated circuits up to 1985 in Western Europe, the U.S., and Japan; and historic development of the semiconductor industry and the prevailing tendencies - factors which influence success in the semiconductor industry. Author (ESA)

88 SPACE SCIENCES (GENERAL)

N78-11899# European Space Agency, Paris (France).
RECENT ADVANCES IN GAMMA-RAY ASTRONOMY
R. D. Wills, ed. and B. Battrick, ed. Jul. 1977 398 p refs Proc. of 12th ESLAB Symp., Frascati, Italy, 24-27 May 1977 (ESA-SP-124) Avail: NTIS HC A17/MF A01

Papers are presented in the field of gamma ray astronomy, some of them checking with COS-B results in this field. Topics discussed cover localized sources of high energy radiation, galactic gamma radiation, cosmic rays in the galaxy, the diffuse gamma ray background, astrophysical and cosmological processes, instrumentation for gamma ray astronomy, measurement and analysis techniques, and gamma ray burst measurements. For individual titles, see N78-11900 through N78-11951.

N78-11900# Palermo Univ. (Italy). Lab. di Fisica Cosmica e Tecnologie Relative.
THE COS-B EXPERIMENT AND MISSION **c89**
L. Scarsi, K. Bennett, G. F. Bignami, G. Boella, R. Buccheri, W. Hermsen, L. Koch, H. A. Mayer-Hasselwander, J. A. Paul, E. Pfeffermann et al *In* ESA Recent Advan. In Gamma-Ray Astronomy Jul. 1977 p 3-11 refs Prepared jointly with Huygens Lab., Milan Univ., MaxPlanck-Inst. fuer Extraterrestrische Phys., Garching, West Ger., CEA, Saclay, France, and ESRTC, Noordwijk, Neth. (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The Cos-B gamma ray detector, orbit, operations and data processing, calibration and in-flight performance, and observation program are described. The Cos-B satellite carries a single spark-chamber experiment capable of detecting gamma rays with energies greater than 30 MeV. The mission objectives are to study the spatial, energy, and time characteristics of high energy radiation of galactic and extragalactic origin. Correlation of X-ray and gamma ray variations is obtained by the inclusion in the payload of a proportional counter sensitive to X-rays of 2 to 12 keV. The satellite was launched in Aug. 1975 into an eccentric polar orbit, chosen to optimize the observability of interesting regions of the sky and the recovery of data.
Author (ESA)

N78-11901# Huygens Laboratium, Leiden (Netherlands).
COS-B OBSERVATIONS OF LOCALISED GAMMA-RAY EMISSION **c93**
W. Hermsen, K. Bennett, G. F. Bignami, G. Boella, R. Buccheri, J. C. Higdon, G. Kanbach, G. G. Lichti, J. L. Masnou, H. A. Mayer-Hasselwander et al *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 13-20 refs Prepared jointly with Milan Univ., Palermo Univ., Italy, Max-Planck-Inst. fuer Extraterrestrische Phys., Garching, West Ger., CEA, Saclay, France, and ESRTC, Noordwijk, Neth. (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The ESA gamma ray satellite COS-B has completed a survey of the galactic plane. The long exposure time combined with the effective angular resolution of about 2.5 deg. (FWHM) for gamma rays above 100 MeV permits a detailed study of the spatial distribution of the radiation. In four observation periods a search for localized gamma ray emission was performed. Each of the regions studied exhibits a significant fine structure superimposed on a diffuse emission along the galactic plane. This fine structure is consistent with the presence of a large number of high-energy gamma ray sources. A first catalog, including 11 so far unidentified gamma ray sources, is presented. The latitude distribution of these sources indicates a galactic nature.
Author (ESA)

N78-11902# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
COS-B RESULTS ON A SEARCH FOR PULSED GAMMA-RAY EMISSION FROM RADIO PULSARS **c93**
G. Kanbach, K. Bennett, G. F. Bignami, G. Boella, M. Bonnardeau, R. Buccheri, N. DAmico, W. Hermsen, J. C. Higdon, G. G. Lichti et al *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 21-32 refs Prepared jointly with Huygens Lab., Milan Univ., Palermo Univ., Italy, CEA, Saclay, France, and ESRTC, Noordwijk, Neth. (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

A search for a pulsed gamma ray emission from sources located in regions near the galactic plane was carried out. For this search, the radio data from a number of pulsars were used. Due to the inadequacy of the available radio pulsar parameters, which had to be derived by extrapolation from observations made in different epochs, the investigation was based on a parameter scan around the predicted value of P. As a result of this search PSR 1822-09 was recognized as a possible gamma ray emitter. The radiation from the already known gamma ray pulsars PSR0531+21 and PSR0833-45 was studied in detail, and results are presented.
Author (ESA)

N78-11903# Commissariat a l'Energie Atomique, Saclay (France). Service D'Electronique Physique.
SEARCH FOR GAMMA-RAY TIME VARIABILITY OF CYGNUS X-3 AND CG 195+4 **c93**
J. L. Masnou, K. Bennett, G. F. Bignami, R. Buccheri, P. Caraveo, N. DAmico, W. Hermsen, G. Kanbach, G. G. Lichti, H. A. Mayer-Hasselwander et al *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 33-37 refs Prepared jointly with Huygens Lab., Milan Univ., Palermo Univ., Italy, Max-Planck-Inst. fuer Extraterrestrische Phys., Garching, West Ger., and ESRTC, Noordwijk, Neth. (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The ESA COS-B satellite investigated the high energy gamma ray emission from the Cygnus region of the galaxy during Nov. and Dec. 1975. From the counts observed to originate within the vicinity of Cygnus X-3, a phase histogram was derived using the 4.8 hr period observed at X-ray and IR wavelengths. The phase analysis reveals no evidence for a modulation of the gamma ray emission at the time of the COS-B observation. The short-term variability of the source CG 195+4 was investigated in detail. This source was found to pulsate with a period of 59.19687 sec and a period derivative of 1.385x10 exp (-9) with a multiple peak phase histogram, consistent with the SAS-2 results. The pulsed fraction above 100 MeV is 75 plus or minus 25%. This preliminary study also indicates a pulsed energy spectrum harder than that of the Crab pulsar.
Author (ESA)

N78-11904# Mount Hopkins Observatory, Amado, Ariz. Center for Astrophysics.
OBSERVATIONS OF THE 100 MeV GAMMA-RAY SOURCES AT ENERGIES OF 100-1000 G EV **c93**
T. C. Weekes and H. F. Helmken *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 39-43 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

Of the sources of gamma rays at energies of 70 MeV discovered by the SAS-2 and COS-B groups, eight were observed with the 10 m reflector on Mt. Hopkins in southern Arizona. All of the observations were in the winter of 1976/7. Because of the positional uncertainty of many of the sources, the detector configuration used was a modified version of that used in the recent high energy Sky Survey. Drift-scans were made on the following sources: (136 deg, + 1 deg), (196 deg, + 4 deg), (120 deg, 0 deg), (98 deg, 0 deg), (187 deg, 0 deg), (175 deg, -5 deg), and (78 deg, 1 deg). The latter scans also included the position of Cyg X-3. At the sensitivity achieved in these observations, none of these sources gave a detectable high energy gamma ray flux.
Author (ESA)

N78-11905*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAS-2 OBSERVATIONS OF HIGH ENERGY GAMMA RAYS FROM DISCRETE SOURCES **c93**
D. A. Kniffen, C. E. Fichtel, R. C. Hartman, R. C. Lamb, and D. J. Thompson *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 45-53 refs (For availability see N78-11899 02-99)
Avail: NTIS HC A17/MF A01

The SAS-2 identified six localized high energy (greater than 35 MeV) gamma ray sources. Four of these are the radio pulsars, PSR 0531+21, PSR 0833-45, PSR 1818-04, and PSR 1717-46 discovered in a search of 75 radio pulsars. The fact that only one of these is observed in X-rays, and the significant differences in pulse profiles in the gamma ray and radio observations, leads to the speculation that different mechanisms are involved.
Author (ESA)

N78-11906# Center for Astrophysics, Cambridge, Mass.
RESULTS OF THE MOUNT HOPKINS SKY SURVEY FOR SOURCES OF 100-1000 GeV GAMMA RAYS **c93**

T. C. Weekes, H. F. Helmken, J. E. Grindlay, and E. Horine *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 55-58 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The 10 m reflector at the Mt. Hopkins Observatory (altitude 2.3 km) has been used in a multiple beam configuration to scan the celestial sphere for point sources of 100 to 1000 GeV gamma rays. During the period December 1974 to September 1976, almost the entire sky between declinations (-10 deg) and (+70 deg) has been surveyed at least once. Results of some 800 hrs of observations are reported; the emphasis was on a search for discrete sources at the lowest energies. Author (ESA)

N78-11907# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
OBSERVATIONS OF CYG X-1 AND THE CRAB NEBULA IN THE 100 keV -4 MeV ENERGY RANGE c93
P. Mandrou, M. Niel, and G. Vedrenne *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 59-66 refs (For availability see N78-11899 02-88)
(Contract CNES-BA-01-02-F)
Avail: NTIS HC A17/MF A01

The Crab Nebula and Cyg X-1 were observed from 100 keV to 4 MeV during two balloon flights in July 1975 and June 1976 with a gamma ray telescope. Results of these two observations are presented. Author (ESA)

N78-11908*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF CELESTIAL X-RAY SOURCES ABOVE 20 keV WITH THE HIGH-ENERGY SCINTILLATION SPECTROMETER ON BOARD OSO-8 c93
C. J. Crannell, B. R. Dennis, J. F. Dolan, K. J. Frost, L. E. Orwig, J. H. Beall (Maryland Univ., College Park), and G. S. Maurer (Catholic Univ. of America) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 67-73 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

High-energy X-ray spectra of the Crab Nebula, Cyg XR-1, and Cen A were determined from observations with the scintillation spectrometer onboard the OSO-8 satellite, launched in June 1975. Each of these sources was observed over two periods of 8 days or more, allowing a search for day-to-day and year-to-year variations in the spectral and temporal characteristics of the X-ray emission. No variation in the light curve of the Crab pulsar was found from observations which span a 15-day period in March 1976, with demonstrable phase stability. Transitions associated with the binary phase of Cyg XR-1 and a large change in the emission from Cen A are reported. Author (ESA)

N78-11909# Palermo Univ. (Italy).
GAMMA-RAY PULSARS: IMPLICATIONS FOR THE RADIATION MECHANISM c93
E. Massaro and M. Salvati (Lab. di Astrofis. Spaziale) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 75-79 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

A model for the gamma ray emission from pulsars, especially designed to reproduce the light curve of PSR 0833-45, is proposed. In accordance with the model of Ruderman and Sutherland, the radiating particles are injected along the open field lines with a given energy, due to gap acceleration, and emit curvature radiation. The equation describing the energy losses is integrated exactly in the limit omega = 0, and is then corrected up to the first order for rotation effects. The transfer equation for the curvature photons takes into account the aberration, the Doppler shift, and the pair production absorption. Computed pulse profiles and averaged spectra are reported, showing that gamma rays are generated in the intermost regions of the magnetosphere and that an observable flux of primary photons can outlive the interaction with the magnetic field. Author (ESA)

N78-11910# European Space Research and Technology Center, Noordwijk (Netherlands).
COS-B OBSERVATIONS OF GALACTIC GAMMA-RAY EMISSION (LARGE-SCALE) c93
K. Bennett, G. F. Bignami, R. Buccheri, W. Hermsen, G. Kanbach, F. Lebrun, H. A. Mayer-Hasselwander, J. A. Paul, G. Piccinotti, L. Scarsi et al *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 83-93 refs Prepared jointly with Huygens Lab., Milan Univ., Palermo Univ., Max-Planck-Inst. fuer Extraterrestrische Phys., Garching, West Ger., and CEA, Saclay, France (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

Most of the regions of the sky already observed by COS-B contain parts of the galactic disc. Detailed analysis has been completed of the data from many of these observation periods. In several cases a manual scanning, effective in removing the background events was incorporated in the processing sequence. The data collected during most of these periods have been merged in order to reveal the structure of the large-scale emission. This large-scale emission features a ridge centered on the galactic equator, showing a variable latitude thickness and significant enhancements along the ridge. While such emission is very bright towards the inner galaxy, it becomes very weak, and in places not apparent, outside the solar circle. The energy spectra of the large scale emission from selected regions have been measured. The spectra derived for different longitude bands do not differ, the form of which resembles neither a pure neutral pion nor a power law form. Author (ESA)

N78-11911*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAS-2 GAMMA-RAY RESULTS FROM THE GALACTIC PLANE AND THEIR IMPLICATIONS FOR GALACTIC STRUCTURE AND GALACTIC COSMIC-RAY DYNAMICS c93
C. E. Fichtel, D. A. Kniffen, and D. J. Thompson *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 95-104 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01 CSCL 03B

The final SAS-2 results related to high energy galactic gamma-ray emission show a strong correlation with galactic structural features seen at other wavelenghts, when the known gamma-ray sources are subtracted. Theoretical considerations and analysis of the gamma-ray data suggest that the galactic cosmic rays are dynamically coupled to the interstellar matter through the magnetic fields, and hance the cosmic ray density is enhanced where the matter density is greatest on the scale of the galactic arms. This concept has been explored in a galactic model that assumes: (1) cosmic rays are galactic and not universal; (2)on the scale of the galactic arms, the cosmic ray column (surface) density is proportional to the total interstellar gas column density; (3)the cosmic ray scale height is significantly larger than the scale height to the matter; and (4) ours is a spiral galaxy characterized by an arm to interarm density ratio of over 2:1.
Author (ESA)

N78-11912# Milan Univ. (Italy). Lab. di Fisica Cosmica e Tecnologie Relative.
GAMMA RAYS FROM ACCRETING BLACK HOLES c93
L. Maraschi and A. Treves *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 105-106 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

Turbulent spherical accretion onto a black hole was considered. Relative velocities between magnetized blobs produce an electric field for which the runaway condition is satisfied and particles can be accelerated. About one tenth of the total power of the accreting hole is radiated by relativistic electrons at energies around 1 to 10 MeV by the synchrotron mechanism and at energies of about 10 GeV by the Compton process.
Author (ESA)

N78-11913# Naval Research Lab., Washington, D. C.
OBSERVATIONS OF GAMMA RADIATION FROM THE GALACTIC CENTER REGION c93
G. H. Share, R. L. Kinzer, J. Samimi (Ferdowsi, Univ., Mashhad, Iran), and A. Jabbari-Azad (Ferdowsi Univ., Mashhad, Iran) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 107-115 refs Partly sponsored by the Office of Naval Res., Ferdowsi Univ. and the Iranian Min. of Sci. and Higher Educ. (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

High resolution measurements of gamma-radiation, greater

than 15 MeV, emitted from the galactic center were made during balloon flights in 1971 and 1975. The prominent feature observed in 1971 is a 29 deg wide enhancement lying along and just below the galactic equator. It is primarily confined and has an energy spectrum which appears to be dominated by pi deg-decay gamma rays greater than 50MeV, but could contain a significant contribution from bremsstrahlung or Compton processes at lower energies. If this radiation is diffuse then cosmic ray collisions on the molecular hydrogen between 4 and 8 kpc from the center is the most probable source; however, its limited extent is puzzling. Data from 1971 and 1975 show that the galactic gamma-rays detected appear to be primarily confined; concentrations that could be due to localized sources are apparent. These concentrations are near some interesting objects including a supernova remnant and two bursting X-ray sources. Also discussed is a search for bursts of high-energy gamma rays. Author (ESA)

N78-11914*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GAMMA-RAY ASTRONOMY IN THE MEDIUM ENERGY (10-50 MeV) RANGE **c89**

D. A. Kniffen, D. L. Bertsch, D. J. Morris (Maryland Univ., College Park), R. A. R. Palmeira (Inst. de Pesquisas Espacias, Sao Paulo, Brazil), and K. R. Rao (Inst. de Pesquisas Espacias, Sao Paulo, Brazil) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 117-124 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01 CSCL 03B

To observe the medium energy component of the intense galactic center gamma-ray emission, two balloon flights of a medium energy gamma-ray spark chamber telescope were flown in Brazil in 1975. The results indicate the emission is higher than previously thought and above the predictions of a theoretical model proposed. Author (ESA)

N78-11915# Milan Univ. (Italy). Lab. di Fisica Cosmica e Tecnologie Relative.

GALACTIC MEDIUM ENERGY GAMMA-RAY ASTRONOMY: A QUANTITATIVE STUDY OF THE INVERSE COMPTON CONTRIBUTION **c93**

G. Piccinotti and G. F. Bignami *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 125-130 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The contribution of the inverse Compton process to the galactic medium energy (10 to 100 MeV) gamma ray emission was analyzed quantitatively. The method and the basic model calculations were those outlined in existing work, including a calculation of the source function at the sun as a starting point. The novelty introduced here is in the use of both new IR data for the photon field description and new speculations on the cosmic ray electron distribution, based on recent work on SNR's. Author (ESA)

N78-11916# Commissariat a l'Energie Atomique, Saclay (France).

BREMSSTRAHLUNG GAMMA RADIATION FROM THE GALAXY **c93**

P. G. Shukla and C. J. Cesarsky *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 131-136 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

A detailed study of the bremsstrahlung gamma ray emission from the galactic disk is presented. It is shown that there are large uncertainities in the production spectrum of photons of energy 10 to 70 MeV, due to lack of knowledge of the interstellar electron spectrum. Expectations of results from future observations of gamma rays in that energy range are discussed. Author (ESA)

N78-11917# Kiel Univ. (West Germany).

A NEW TEST FOR THE ORIGIN OF GALACTIC GAMMA RAYS **c93**

R. Schlickeiser and K. O. Thielheim *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 139-145 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The variation of the ratio of the galactic gamma ray flux in the two energy intervals 70 to 300 MeV and 300 to 2000 MeV is derived as a function of galactic latitude for two longitudinal regions using COS-B gamma-ray data. It is shown that this energy ratio is a good test between a more proton and a more electron induced origin of galactic gamma rays. Astrophysical information is used about the spatial distribution of interstellar matter, starlight, and primary cosmic rays and the energy-dependent angular resolution of the COS-B detector is taken into account. Author (ESA)

N78-11918# Durham Univ. (England).

PROPAGATION OF COSMIC-RAY PRIMARY AND SECONDARY ELECTRONS IN DENSE INTERSTELLAR CLOUDS, AND IMPLICATIONS FOR GAMMA-RAY PRODUCTION **c93**

A. W. Strong and J. Skilling (Cambridge Univ., Engl.) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 147-151 refs Partly sponsored by the Commissioners for the Exhibition of 1851 (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The movement of primary and secondary electrons into and out of dense molecular clouds is inhibited by resonant Alfven waves generated by cosmic-ray nuclei and by the cosmic-ray electrons themselves. The theory described in an earlier paper is extended to the multi-species case, including the generation of secondary electrons within the clouds. The waves cause the electron density within a cloud to diminish, and this causes a corresponding reduction in the expected flux of bremsstrahlung gamma rays from clouds. The reduction for various values of cloud thickness and external cosmic-ray intensity is given. Author (ESA)

N78-11919# Commissariat a l'Energie Atomique, Saclay (France).

COSMIC-RAY PENETRATION INTO MOLECULAR CLOUDS **c93**

C. J. Cesarsky and H. J. Voelk (Max-Planck-Inst. fuer Kernphys.) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 153-156 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

Assuming dense interstellar clouds to be threaded by the general galactic magnetic field, the role of magnetic fields in reducing the interior cosmic ray intensity was investigated. The diffusive effects of small scale irregularities inside and outside the cloud, and of large scale hydromagnetic waves, were found to be negligible down to energies of some tens of MeV/nucleon; therefore, quasistatic magnetic mirrors which may arise at local condensations and trap particles over time scales long enough so that the trapped cosmic ray population is absent due to losses. This energy independent effect can lead to an average reduction of gamma-ray luminosity and hydrogen ionization rate of about 50%. At the same time density contrasts in the gas are considerably emphasized in the gamma-light. Author (ESA)

N78-11920# Durham Univ. (England).

GRADIENT OF COSMIC RAYS TOWARDS THE GALACTIC CENTRE **c93**

A. W. Wolfendale and E. C. M. Young (Hong Kong Univ.) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 157-160 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

A critical analysis was made of the gamma-ray data within + or -40 deg of the galactic center in an attempt to estimate the distribution of cosmic rays (1 to 10 GeV) between the earth and the galactic center. It was concluded that the cosmic rays are probably distributed in a manner similar to that of supernovae and pulsars but the uncertainties are as yet very great. Author (ESA)

N78-11921# Durham Univ. (England).

GAMMA RAYS FROM COSMIC RAYS IN THICK TARGETS AND APPLICATION IN THE GALACTIC 300pC H2 RING **c93**

A. W. Wolfendale and D. M. Worrall *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 161-165 refs Partly sponsored by Sci. Res. Council (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The neutral pion-decay gamma-ray emissivity from trapped cosmic rays is calculated in terms of the ratio of proton production rate in the region to that locally, f. The electron contributions

depend on the characteristics of the region. A calculation is presented for the galactic center, from which direction SAS-2 observes a high gamma-ray enhancement. The results support a galactic origin for most cosmic rays in the energy range 1 to 10 GeV. The relationships between gas density, magnetic field and f are examined. Author (ESA)

N78-11922# Durham Univ. (England).
GAMMA RAYS AND THE COSMIC-RAY GRADIENT AWAY FROM THE GALACTIC CENTRE **c93**
A. W. Strong, A. W. Wolfendale, K. Bennett (ESRTC, Noordwijk, Neth.), and R. D. Wills (ESRTC, Noordwijk, Neth.) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 167-170 refs Partly sponsored by the Commissioners for the Exhibition of 1851 (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The latitude distribution of gamma-rays in the glactic anticenter as measured by the COS-B satellite was compared with that expected from interactions between cosmic rays and the interstellar gas. Both the variation in absolute magnitude and shape of the distribution suggest a low density of 1 to 10 GeV cosmic rays in the Perseus arm and beyond, confirming the galactic origin of these particles. Author (ESA)

N78-11923*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GALACTIC GAMMA RAYS AND THE COSMIC-RAY HALO PROBLEM **c93**
F. W. Stecker and F. C. Jones *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 171-177 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01 CSCL 03B

Detailed models of diffused halos of various sizes are considered. In such models, the scale perpendicular to the plane has a strong effect in determining the distribution of cosmic rays. Radial distributions were calculated for cylindrical coordinate models. The implied gamma-ray longitude distributions were then calculated and compared with the SAS-2 data. Assuming the sources to be supernova remnants or pulsars, only cosmic-ray nucleon halo models with an upper limit scale height of about 3 kpc provide a good fit to the gamma ray data. Consideration of the gamma-ray latitude data gives a half thickness of 2 + or - 2 kpc for the cosmic ray electron halo. Author (ESA)

N78-11924*# Imperial Coll. of Science and Technology, London (England).
REANALYSIS OF THE APOLLO COSMIC GAMMA-RAY SPECTRUM IN THE 0.3 TO 10 MeV ENERGY REGION **c93**
C. S. Dyer, J. I. Trombka (NASA Goddard Space Flight Center, Greenbelt, Md.), L. G. Evans (Computer Sci. Corp.), M. J. Bielefeld (Computer Sci. Corp.), S. M. Selzer (NBS, Washington, D.C.), and A. E. Metzger (JPL, Pasadena) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 181-189 refs (For availability see N78-11899 02-88)
(Grant NGL-21-002-033)
Avail: NTIS HC A17/MF A01 CSCL 03B

Additional data obtained from the Apollo 16 and 17 missions, together with collateral calculations on background radiation effects, have made possible an improved subtraction of unwanted backgrounds from the diffuse cosmic gamma ray data previously reported from Apollo 15. As a result, the 1 to 10 MeV spectrum is lowered significantly and connects smoothly with recent data at other energies. The inflection reported previously is much less pronounced and has no more than 1.5 sigma significance. Sky occultation by the Apollo 16 spacecraft shows the bulk of the 0.3 to 1 MeV radiation to be diffuse. The analysis of spurious backgrounds points to important improvements for future experiments designed for this spectral region. A light-weight satellite design can give a fourfold improvement in the signal to noise for such a measurement. Use of an anisotropic central crystal, which spins quickly compared with possible time variations in detector background, would enable sensitive limits to be set on galactic plane and point source contributions. Author (ESA)

N78-11925*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CELESTIAL DIFFUSE GAMMA-RAY EMISSION OBSERVED BY SAS-2 AND ITS INTERPRETATION **c93**
C. E. Fichtel, D. A. Kniffen, R. C. Hartman, D. J. Thompson, H. Gelman (Middle East Tech. Univ.), M. Ozel (Middle East Tech. Univ.), and T. Tumer (Middle East Tech. Univ.) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 191-200 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01 CSCL 03B

A clearly established diffuse celestial gamma-ray component was seen by SAS-2 above 35 MeV, after examining several regions of the sky at different latitudes, including the north celestial pole. For energies above 100 MeV the gamma ray results are consistent with an equation of the form $I(b) = C1 + C2/\sin b$ with the second term being dominant, suggesting that the radiation above 100 MeV comes largely from the local regions of the galactic disk. Between 35 and 100 MeV, a similar equation is also a reasonable representation of the data, but here the two terms are comparable, with the first, or isotropic term, actually being the larger one. In addition to indicating that the diffuse radiation is partially galactic, these results imply a steepness for the energy spectrum of the diffuse isotropic component which places significant constraints on possible theoretical models of this radiation. Author (ESA)

N78-11926*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA RAYS AND THE CASE FOR BARYON SYMMETRIC BIG-BANG COSMOLOGY **c90**
F. W. Stecker *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 201-206 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01 CSCL 03B

The baryon symmetric big-bang cosmologies offer an explanation of the present photon-baryon ratio in the universe, the best present explanation of the diffuse gamma-ray background spectrum in the 1 to 200 MeV range, and a mechanism for galaxy formation. In the context of an open universe model, the value of omega which best fits the present gamma-ray data is omega equals approx. 0.1 which does not conflict with upper limits on Comptonization distortion of the 3K background radiation. In regard to He production, evidence is discussed that nucleosynthesis of He may have taken place after the galaxies were formed. Author (ESA)

N78-11927# European Space Research and Technology Center, Noordwijk (Netherlands).
THE GAMMA-RAY LUMINOSITY OF SPIRAL GALAXIES, ITS EVOLUTION AND ITS CONTRIBUTION TO THE DIFFUSE BACKGROUND ABOVE 100 MeV **c90**
G. G. Lichti, G. F. Bignami (Milan Univ.), and J. A. Paul (CEA, Saclay, France) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 207-210 refs Partly sponsored by ESA (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The contribution of normal spiral galaxies to the high galactic latitude gamma-ray background greater than 100 MeV was examined in the light of the estimates of its flux from the SAS-2 measurements. The gamma ray luminosity of each object is inferred from the known Milky Way value normalized to the corresponding optical quantity. Several possibilities were considered for the responsible physical production mechanism both diffuse and localized; these were then set to evolve with the galactic age according to 3 well-known evolutionary models. A final spacetime integration led to results, expressed as a fraction of the measured background. It is seen that the model presented can play an important role in the region greater than 100 MeV where the information on the spectral shape of the radiation is still very poor. Author (ESA)

N78-11928*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA-RAYS FROM THE DE-EXCITATION OF 12C*(15.11 MeV) AND 12C*(4.44 MeV) AS PROBES OF ENERGETIC PARTICLE SPECTRA **c93**
C. J. Crannell, R. Ramaty (Catholic Univ. of America), and H. Crannell *In* ESA Recent Advan. In Gamma-Ray Astronomy Jul. 1977 p 213-217 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01 CSCL 03B

The flux of 15.11 MeV gamma-rays relative to the flux 4.44 MeV gamma-rays was calculated from measured cross sections for excitation of the corresponding states of 12C and from experimental determinations of the branching ratios for direct de-excitation of these states to the ground state. Because of the difference in threshold energies for excitation of these two levels, the relative intensities in the two lines are particularly sensitive to the spectral distribution of energetic particles which excite the corresponding nuclear levels. For both solar and cosmic emission, the observability of the 15.11 MeV line is expected to be enhanced by low-source background continuum in this energy range. Author (ESA)

N78-11929# Kiel Univ. (West Germany).
CRITICAL REEXAMINATION OF ELECTROMAGNETIC GAMMA-RAY SOURCE FUNCTIONS c93
R. Schlickeiser and K. O. Thielheim *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 219-224 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

Cosmic gamma-ray production by bremsstrahlung in the interstellar gas and inverse Compton scattering of 2.7 K blackbody microwave photons involves cosmic ray electrons with energies below 1 GeV and above 100 GeV, respectively. In these energy ranges the electron energy spectrum is rather poorly known and quite uncertain. The influence of this uncertainty on the gamma-ray source functions was estimated. It is shown that for both processes the integral source function above 100MeV is uncertain to at least a factor of 8 (bremsstrahlung) and 6 (microwave photon scattering). The consequences for galactic and extragalactic gamma ray astronomy are discussed. Author (ESA)

N78-11930# Commissariat a l'Energie Atomique, Saclay (France).
LIGHT ELEMENT PRODUCTION BY COSMOLOGICAL COSMIC RAYS AND THE GAMMA-RAY BACKGROUND c93
T. Montmerle *In* ESA Recent Advan. in Gamma-Ray Astronomy 1977 p 225-234 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The view that was examined which was the 1 to 100 MeV gamma-ray background is of cosmological origin and is produced by high-energy collisions in a burst at high redshifts (about 100) between cosmic rays and the ambient gas, as suggested by Stecker (1969). To test this cosmological cosmic ray (CCR) hypothesis, use was made of the fact that, simultaneously, low energy interactions give birth to the light elements D, He-3, Li-6, Li-7 and Be-7. Their resulting abundances are calculated by normalizing the CCR flux to the observed gamma-ray background. Since it is possible to find the correct (observed) Li-7 abundance, which is otherwise unexplained as yet, by this process, it is of interest to discuss the various uncertainities involved in the calculations. Among these, the spread of the present gamma-ray data, especially between 1 and about 10 MeV, is a major uncertainty, and emphasis is put on its influence on the results and, as a consequence, on the validity of the CCR hypothesis. Author (ESA)

N78-11931# Commissariat a l'Energie Atomique, Saclay (France).
COS-B AND COSMOLOGY c90
T. Montmerle *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 235-239 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The 1 to 100 MeV gamma-ray background is currently believed to be of cosmological origin. It has been suggested that it originates from neutral pion decay, either in a burst of cosmological cosmic rays (CCR) interacting with the ambient gas or in some annihilation process between macroscopic regions of matter and antimatter, both at high redshifts (zs equals about 100). It is thus of interest to see to what extent present-day experiments are fitted to test such hypotheses, for instance by revealing the presence of spatial fluctuations in the gamma-ray background due to photons coming from zs. To this end and for ESA's COS-B gamma-ray satellite, the corresponding theoretical spectra are folded through the efficiency of the detector, in order to compute COS-B's gamma-ray visibility function (Montmerle 1975). Because of its reduced efficiency at energies less than 70 MeV, COS-B sees only local background gamma-ray photons (i.e. coming essentially from z less than 10) in the annihilation hypothesis. The situation is somewhat better in the CCR hypothesis, but the image contrast should be rather poor. COS-B is thus not well suited to give information on high-energy phenomena occurring at high redshifts. Author (ESA)

N78-11932# Catholic Univ. of America, Washington, D. C.
A HYBRID MULTIWIRE PROPORTIONAL-DRIFT CHAMBER FOR USE IN GAMMA-RAY ASTRONOMY c89
H. Crannell and G. S. Maurer *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 243-248 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The direction of an incident high-energy gamma-ray can be determined by accurately measuring the direction of the electron-positron pair created by the photon conversion. The operation of a hybrid multiwire-drift proportional chamber is described. Track position is obtained to within a small fraction of the anode wire spacing over a wide range of incident angles. Both track position and angle information are obtained from a single anode-plane crossing. A method of employing a multiple delay-line readout to obtain the position and direction of both members of an electron-positron pair is described. Author (ESA)

N78-11933# European Space Research and Technology Center, Noordwijk (Netherlands).
A NEW DETECTOR FOR GAMMA-RAY ASTRONOMY c89
S. P. McKechnie, K. Bennett, A. vanDordrecht, and D. Ramsden (Southampton Univ., Engl.) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 249-256 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The new detector described operates in the 100 MeV region. High angular resolution is accomplished by means of drift chambers which replace conventional spark chambers. Performance figures are presented based on the evaluation of a prototype detector stack using gamma and electron beams at Desy, Hamburg. Author (ESA)

N78-11934# Commissariat a l'Energie Atomique, Saclay (France).
AGATHE: A ONE SQUARE METER GAMMA-RAY SPARK CHAMBER BALLOON TELESCOPE WITH LOW ENERGY THRESHOLD AND HIGH ANGULAR ACCURACY c89
B. Parlier, B. Agrinier, E. Bonfand, E. Mougin, A. Lecomte, J. Andrejol, J. C. Courtois, J. M. Lavigne (Centre d'Etude Spatiale des Rayonnements), M. Niel (Centre d'Etude Spatiale des Rayonnements), G. Vedrenne (Centre d'Etude Spatiale des Rayonnements) et al *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 257-261 refs Sponsored by CNES (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The Agathe balloon experiment carried out by the CEA of Saclay and the CESR of Toulouse is designed for the study of gamma radiation in the energy range 10 to 100 MeV. The construction of the experimental system and the results obtained during a test flight are described. Author (ESA)

N78-11935# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
SOVIET-FRENCH INVESTIGATIONS IN GAMMA-RAY ASTRONOMY c89
In ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 263-268 refs Prepared jointly with CEA, Saclay, France, Inst. of Space Res., Moscow, Inst. of Eng. Phys., Moscow, Phys.-Tech. Inst., Leningrad, and Inst. of Phys., Moscow (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The U.S.S.R. and France are developing a long term program in gamma-ray astronomy, especially for the study of high energy gamma-rays and gamma-ray bursts. This program and the experiments to be launched in the next few years are briefly described. Author (ESA)

N78-11936# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
THE SOVIET-FRENCH EXPERIMENT 'GAMMA I' FOR HIGH ENERGY GAMMA-RAY ASTRONOMY c89
R. Bazer-Bachi, F. Cottin, J. M. Lavigne, P. Mandrou, V. Akimov

(Acad. of Sci., Moscow), M. Dobriyan (Acad. of Sci., Moscow), M. Fradkin (Acad. of Sci., Moscow), L. Kalinkin (Acad. of Sci., Moscow), V. Nesterov (Acad. of Sci., Moscow), S. Tabaldeiev (Acad. of Sci., Moscow) et al *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 269-275 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

Gamma I was designed to detect gamma-rays above 50 MeV in order to study the extraterrestrial high energy gamma radiation. The experiment consists of (1) two wide-gap spark chambers, the upper one being surrounded by a set of anticoincidence counters, (2) a triggering telescope which includes both Cerenkov and time-of-flight techniques for the rejection of moving-up particles, (3) a lead-plastic sandwich calorimeter, and (4) a video-recording device in order to handle the sparkchamber information. The angular resolution achieved with a scientifically representative model of the spark chamber is of order of 2 deg at 100 MeV. Sensible energy measurement can also be performed using the pair-electron diffusion for gamma ray energy less than or equal to 200 MeV. The effective area for detection of gamma-rays was estimated using the Monte Carlo method.
Author (ESA)

N78-11937# Institute of Engineering Physics, Moscow (USSR).
APPLICATION OF SCINTILLATION TIME-OF-FLIGHT POSITION-SENSITIVE DETECTOR SYSTEMS FOR GAMMA-RAY TELESCOPES OF LARGE AREA **c89**
V. G. Bondarenko, A. M. Galper, V. A. Grigoriev, A. A. Koliubin, E. F. Makliaev, and I. S. Markina *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 277-278 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The scintillation time-of-flight position-sensitive detector system can be used in cosmic gamma-ray telescopes to measure the coordinates of the secondary particles. Calculations show that such a system, being of very simple construction, can provide an effective telescope area of several square meters. The dead time of such a telescope is very small and an angular resolution of a few degrees can be achieved. Author (ESA)

N78-11938# Mount Hopkins Observatory, Amado, Ariz. Center for Astrophysics.
GAMMA-RAY ASTRONOMY FROM 10-100 GeV: A NEW APPROACH **c89**
T. C. Weekes and K. E. Turver (Durham Univ., Engl.) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 279-286 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

Recent advances in gamma-ray astronomy at satellite energies suggest a new look at the experimental technique at high energies. The suggestion that proton induced showers of energy 100 GeV are deficient in Cerenkov light compared with gamma ray showers indicates that gamma ray experiments in the range 10 to 100 GeV would be extremely fruitful. Results of the computer simulations are presented and a qualitative description is given of an experiment which would exploit this feature; this would involve the use of two parallel large reflectors each equipped with multiple detector channels to provide two images of the shower in Cerenkov light. Author (ESA)

N78-11939# Case Western Reserve Univ., Cleveland, Ohio.
OBSERVATIONS WITH A ONE SQUARE METER BALLOON-BORNE GAMMA-RAY DETECTOR IN THE ENERGY RANGE ABOVE 10 MeV **c33**
P. Albats, B. Denehy, G. M. Frye, T. L. Jenkins, R. Koga, and S. M. Schindler *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 287-291 refs Sponsored by NSF (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

A large area gamma-ray detector was flown on Oct 10, 1976, at an altitude of 1.55 millibars and at 32 deg north latitude. The instrument consists of an array of 16 multiwire proportional counters interspersed with sheets of tantalum which serve as a converter. The detection of downward moving particles from the bottom of the array, in anticoincidence with counters on the top and sides, caused the proportional counter array to be read out. Prior to the flight, the instrument was calibrated using 20 MeV gamma-rays. The flight observed the region in right ascension from 22 to 11 hrs and declination from 0 to 65 deg north. Preliminary results of an analysis of the flight data and results of the calibration are presented. Author (ESA)

N78-11940# Commissariat a l'Energie Atomique, Saclay (France).
RECENT MEASUREMENTS WITH A BALLOON-BORNE Ge(Li) SPECTROMETER IN GAMMA-RAY ASTRONOMY **c35**
D. Boclet, J. Claisse, P. Durouchoux, E. Olivier, P. Pagnier, R. Rocchia, F. Albernhe (Centre d'Etudes Spatiales des Rayonnements), M. Frabel (Centre d'Etudes Spatiales des Rayonnements), G. Vedrenne (Centre d'Etudes Spatiales des Rayonnements), and J. Marques (Inst. des Pesquisas Espacias, Sao Paolo, Brazil) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 293-299 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

A new high resolution gamma-ray spectrometer, aimed at stellar measurements, was jointly developed at Saclay and Toulouse. The instrument consists of a large Ge (Li) crystal (140 cu cm) cooled at liquid nitrogen temperature and actively shielded by a sodium iodide crystal. Spectral resolution and effective area are, respectively, 3.0 KeV(FWHM) and 2.7 sq cm at 1 MeV. Three flights were carried out in Brazil (Dec. 76, Feb. 77) onboard a stabilized gondola. The background total counting rate was about 10 counts/s in the 0.1 to 8 MeV energy range at floating altitude. Preliminary results and future developments are described. Author (ESA)

N78-11941# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
THE MPI IMAGING DOUBLE COMPTON TELESCOPE FOR OBSERVATIONS OF MeV GAMMA RADIATION **c89**
F. Graml, F. P. Penningsfeld, and V. Schoenfelder *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 301-307 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

An imaging double Compton telescope for low energy gamma-ray astronomy between 1 to 20 MeV is presently being developed and will be flown for the first time on a balloon in the autumn of 1977. The telescope consists of two mosaic type detectors, the upper one consisting of liquid scintillator NE 213, the lower one of NaI(T1). A gamma-ray is identified by a Compton collision in the upper detector and second interaction in the lower one, which is 1.20 m apart. This sequence is confirmed by a time-of-flight measurement. The properties of the telescope are presented: its energy and angular resolution and its detection efficiency. Its sensitivity for the detection of localized gamma-ray sources and of gamma-ray lines in their energy spectra during a balloon flight is presented. Author (ESA)

N78-11942# Palermo Univ. (Italy). Lab. di Fisica Cosmica e Tecnologie Relative.
PULSAR SEARCH IN THE GAMMA-RAY ENERGY RANGE AND EVALUATION OF THE PULSAR RELEVANT PARAMETERS **c89**
R. Buccheri, N. DAmico, L. Scarsi, G. Kanbach (Max-Planck-Inst. fuer Extraterrestrische Phys., Garching, West Ger.), and J. L. Masnou (CEA, Saclay, France) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 309-316 refs Partly sponsored by Comitato Regionale Siciliano Ric. Nucl. (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The low statistics available and the long observation time required make the pulsar search in the gamma-ray energy range critically dependent on the precise knowledge of the period and period derivative of the source at the epoch of observation. The implications of an analysis based on a scanning in period P and its first derivative around approx. input values derived from radio data obtained at a different epoch, are discussed.
Author (ESA)

N78-11943# University Coll., Dublin (Ireland).
POSSIBLE NEW METHODS OF DETECTING COSMIC-RAY ELECTRONS BY THEIR SYNCHROTRON RADIATION IN THE GEOMAGNETIC FIELD AND INTERSTELLAR MAGNETIC FIELD **c93**
B. McBreen *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 319-321 refs (For availability see N78-11899

02-88)
Avail: NTIS HC A17/MF A01

New methods are suggested for distinguishing primary electrons above 10 to power 14 eV from other primaries based on their synchrotron radiation in the geomagnetic field. In addition, it is shown that the synchrotron gamma-ray emission from electrons above 5 X 10 to power 18 eV may be used to detect these electrons at distances up to 10 to power 15 from the earth with collection areas of about 10 to power 7 sq km.
Author (ESA)

N78-11944# Consiglio Nazionale delle Ricerche, Bologna (Italy). Lab. TESRE.
THE LIMITS OF NON-DIRECTIONAL DETECTORS: DIFFUSE BACKGROUND AND ANISOTROPY MEASUREMENTS **c35**
G. Cavallo, H. M. Horstman, and E. Moretti-Horstman *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 323-325 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

Limits can be set to the applications of intrinsically nondirectional detectors. It appears that they are basically due to the inability of these instruments to determine experimentally the diffuse background, the crystal background, and the spurious background produced in the surrounding matter (such as a collimator). In a previous paper the analysis was performed for a number of simplified experimental arrangements in which this statement could be proved. More complex situations were analyzed finding as yet no exception. Considering background anisotropy measurements making use of shaped crystal detectors, it is shown that it is impossible to determine by means of a flat disk crystal the first two coefficients of the expansion of the celestial background into spherical harmonics of the appropriate angles, thus reducing the effectiveness of this method. A different arrangement is therefore suggested. Author (ESA)

N78-11945 Imperial Coll. of Science and Technology, London (England).
ASSESSMENT OF BACKGROUND RADIATION EFFECTS IN LOW ENERGY GAMMA-RAY ASTRONOMY **c89**
C. S. Dyer *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 327-338 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

Background radiation produced in detector and spacecraft materials by the interactions of cosmic rays and trapped protons must be understood and minimized in the full potential of gamm-ray astronomy in the photon energy range 20 keV to 20 MeV MeV. Calculation schemes for assessing radioactivity induced in detector crystals have been developed and are being improved by comparisons with monoenergetic irradiation results at 600 MeV, 800 MeV, and 6 GeV. Application of these calculations to results from the OSO satellites shows that the induced activity can be well explained by spallation interactions of primary protons. Results from Apollos 15 to 17 and Apollo-Soyuz show that for heavy spacecraft, secondary neutrons can significantly enhance the background. Results from these missions also provide important information concerning gamma-ray lines and continuum produced in the spacecraft and detector housing. Spallation calculations are also being performed for germanium. Author (ESA)

N78-11946# Consiglio Nazionale delle Ricerche, Bologna (Italy). Lab. TESRE.
PRELIMINARY APPLICATION OF A NEW METHOD FOR THE ANALYSIS OF BALLOON-BORNE DIFFUSE BACKGROUND MEASUREMENTS **c35**
E. Moretti-Horstman and H. M. Horstman *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 339-342 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The well-known difficulty of separating the counting rate of a balloon-borne detector into the local and the cosmic contribution is discussed applying a newly proposed method. This method consists in the derivation of an atmospheric source function (which includes scattered primaries) using only the data and making no hypothesis as to its form. This experimentally determined function is then integrated to calculate the local component and the primary residual. A preliminary application to data from a recent balloon flight indicates the efficiency of the method.
Author (ESA)

N78-11947# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
THEORETICAL ZENITH ANGLE DISTRIBUTION OF ATMOSPHERIC MeV GAMMA RADIATION AT HIGH BALLOON ALTITUDES **c93**
U. Graser and V. Schoenfelder *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 343-350 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

A simple model was developed in order to interpret the recently measured zenith angle distribution of MeV gamma-rays in the upper atmosphere, which shows a maximum of intensity at angles around 120 deg (upward moving direction). Because gamma-ray production by electron bremsstrahlung is by far the most important process in this energy range, an attempt was made to derive the gamma-ray source functions within the atmosphere from measured electron fluxes. The transport of gamma-rays from their source position to the detector altitude was simulated in a Monte Carlo calculation. The calculation shows that the observed maximum around zenith angles of 120 deg is caused by those gamma-rays which were originally ejected preferentially in the horizontal direction but which were Compton-scattered on their way to the detector. Because the mean Compton scattering angle and the scattering probability depend on energy, the maximum in the zenith angle distribution varies with energy: with increasing energy it is more and more shifted towards 90 deg. Author (ESA)

N78-11948# Center for Astrophysics, Cambridge, Mass.
CODED DEPARTURE DETECTOR FOR HIGH PRECISION GAMMA-RAY BURST SOURCE LOCATIONS **c35**
H. Helmken and P. Gorenstein *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 353-359 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

Coded aperture collimators in conjunction with position-sensitive detectors are very useful in the study of transient phenomena because they combine a broad field of view, high sensitivity, and an ability for precise source locations. Since the preceding conference, a series of computer simulations of various detector designs have been carried out with the aid of a CDC6400. Particular emphasis was placed on the development of a unit consisting of a one-dimensional random or periodic collimator in conjunction with a two-dimensional position-sensitive xenon proportional counter. A configuration involving four of these units has been incorporated into the preliminary design study of the Transient Explorer satellite and are applicable to any SAS or HEAO type satellite mission. Results of this study, including detector response, field of view, and source location precision, are presented. Author (ESA)

N78-11949# Consiglio Nazionale delle Ricerche, Bologna (Italy). Lab. TESRE.
GAMMA-RAY BURST FREQUENCY AS SEEN BY BALLOON-BORNE DETECTORS **c35**
H. M. Horstman, L. Bassani (Bologna Univ.), and E. Moretti-Horstman *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 361-363 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

The burst frequency N(greater than S) observable by detectors in the atmosphere is proportional to that seen far from the earth but depends on depth, angular distribution, and incident spectrum. The corresponding factors were calculated for both an isotropic distribution and for a disk population (for latitude 40 deg) as seen by a 2pi and a 4pi flat omnidirectional detectors at different depths in the atmosphere. The effects of multiple scattering and absorption of the incident photons are included and results are tabulated for three different input spectra.
Author (ESA)

N78-11950*# Naval Research Lab., Washington, D. C.
SPECTRA OF COSMIC GAMMA-RAY BURSTS IN THE HARD X-RAY RANGE **c93**

G. H. Share and S. R. Kane (Calif. Univ., Berkeley) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 365-373 refs Submitted for publication (For availability see N78-11899 02-88)
(Grant NGL-05-003-017)
Avail: NTIS HC A17/MF A01 CSCL 03B

Hard X-ray measurements of six gamma-ray bursts observed by detectors on the OGO-5 and OSO-6 satellites during the period Oct. 1969 to Apr. 1971 are presented. Spectra for five of the six bursts were determined using measurements from both satellites in order to reduce ambiguities due to uncertain source locations. A significant fraction, 20 to 60%, of the energy of the bursts fall in the hard X-ray range (20 to 130 keV). The time-integrated spectra were fitted by power-law, exponential, and thermal bremsstrahlung functions. They are consistent with power-laws which steepen at energies approx. above 150 keV, as reported earlier for two other bursts. Evidence for spectral variability from event to event in the hard X-ray region is presented. The hard X-ray spectra of the gamma-ray bursts differ from those of the recently discovered 1 to 15 keV bursts.
Author (ESA)

N78-11951# Center for Astrophysics, Cambridge, Mass.
A SEARCH FOR GAMMA-RAY BURSTS FROM THE EXPLOSIVE EVAPORATION OF BLACK HOLES c93
T. C. Weekes and N. A. Porter (Univ. Coll., Dublin) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 375-378 refs Partly sponsored by Smithsonian Res. Found. and Natl. Sci. Council of Ireland (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

Separated atmospheric Cerenkov detectors were used to search for bursts of gamma-rays, not associated with single air showers, predicted theoretically from the explosion of small black holes. Characteristic detectable energies are in the region 200 to 1,000 MeV but higher energy photons would also be detected. Detection sensitivities are in the region 10 to power (-13) to 10 to power (-11) joules/sqm for bursts of duration less than 1 microsecond. In a preliminary analysis an upper limit for primordial black hole explosions in the galaxy is set at 0.04 events/pc3-year.
Author (ESA)

N78-11952*# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
THE AEROSPACE CORPORATION SPACE SCIENCES PROGRAM Interim Report
George A. Paulikas 29 Jul. 1977 13 p refs
(Contracts NAS8-29602; NASw-2879; NAS8-23788; F04701-76-C-0077; Grant NSF ATM-75-18118)
(NASA-CR-154511; AD-A043372; TR-0077(2260-20)-10; SAMSO-TR-77-155) Avail: NTIS HC A02/MF A01 CSCL 03/2

This report reviews the results obtained by the space research program in solar physics, magnetospheric physics, and aeronomy and atmospheric science.
GRA

N78-11953# Netherlands Committee for Geophysics and Space Research, Amsterdam.
SPACE RESEARCH IN THE NETHERLANDS, 1976
1977 31 p refs Presented at the 20th COSPAR Plenary Meeting and Assoc. Activities, Tel Aviv, 7-18 Jun. 1977
Avail: NTIS HC A03/MF A01

The membership and task of the Netherlands National Committee are outlined, followed by reports of the working groups in solar and stellar space research, cosmic rays, photometry, and satellite geodesy.
ESA

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N78-11954 Princeton Univ., N. J.
THE EQUILIBRIUM AND RADIAL OSCILLATIONS OF COOL STELLAR DISKS, VOLUME 1 - 3 Ph.D. Thesis
Ellen Gould Zweibel 1977 105 p
Avail: Univ. Microfilms Order No. 77-16900

Observed stars which lie in axisymmetric disks in spiral galaxies were considered. Equations used to study the radial modes of oscillation of these cool stellar disks of arbitrary structure were derived. Cool disk equilibrium was studied along with the response of a cool stellar disk to an axisymmetric potential perturbation of longer wavelength than the radial average stellar orbit. The linearized Vlasov equation and Poisson's equation were used in the later calculations.
Dissert. Abstr.

N78-11955*# Planetary Science Inst., Tucson, Ariz.
PLANETARY ASTRONOMY PROGRAM Final Report
15 Oct. 1977 177 p refs
(Contract NASw-2983)
(NASA-CR-154512) Avail: NTIS HC A09/MF A01 CSCL 03A

A program was developed in which asteroids and two planets, namely, Saturn and Uranus, were investigated. This included: (1) asteroid spectrophotometry; (2) the nature of the Trojan asteroids; (3) an investigation to determine asteroid masses; (4) the photometry, structure, and dynamics of the rings surrounding the planet Saturn; and (5) aerosol distribution in the atmosphere of Uranus. Plans were finalized to obtain observations of the nucleus of the dying comet P/Arend-Rigaux. Further work was accomplished in asteroid data reduction. Data were entered into the TRIAD data file and a program generated classifications for over 560 different asteroids. A photoelectric area scanner was used to obtain UBV scans of the disk of the planet Saturn on several winter and spring nights in 1977. Intensity profiles show pronounced limb brightening in U, moderate limb brightening in B, and limb darkening in V. Narrow band photoelectric area-scanning photometry of the Uranus disk is also reported. Results are given.
G.D.H.

N78-11956# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ASTROMETRY IN SMALL FIELDS
Laurence G. Taff 14 Jun. 1977 64 p refs
(Contract F19628-76-C-0002)
(AD-A043568; TN-1972-2; ESD-TR-77-163) Avail: NTIS HC A04/MF A01 CSCL 03/1

This report discusses the techniques and analysis for the precise reduction of the topocentric and apparent places of stars and artificial satellites. Included is a full discussion of the method of star constants, independent day numbers, geocentric parallax, parallactic refraction, and errors. Also described, in detail, is the analysis necessary for the real time modeling of the telescope-camera system, its theoretical basis, and differential reduction procedures. In addition, an original method for computing the distance of an artificial satellite from two measurements of position and one of angular velocity is developed.
Author (GRA)

N78-11957# Royal Observatory, Edinburgh (Scotland).
TOPICS IN EXTRAGALACTIC ASTRONOMY WITH SPECIAL REFERENCE TO THE SOUTHERN HEMISPHERE
Gerard deVaucouleurs (Texas Univ., Austin) 1977 201 p refs
(ROE-OR-2; ISBN-0-902553-17-8) Avail: NTIS HC A10/MF A01

Topics discussed are: classification of galaxies; photometry; luminosity distribution laws and integrated magnitudes; colorimetry, in particular in the UBV system; spectroscopy and K-corrections; type I supernovae; metric and photometric diameters; primary, secondary, and tertiary distance indicators; structure of local superclusters; anisotropy of the red shifts and kinematics at the local supercluster; large scale distribution of galaxies; multiplets and groups, clusters and superclusters; galaxy counts and probes in depth; and problems of the Southern Hemisphere; the galaxy and the magellanic clouds, and galaxies.
ESA

N78-11958# Royal Greenwich Observatory, Herstmonceux (England).
[ACTIVITIES OF THE ROYAL GREENWICH OBSERVATORY] Annual Report, Oct. 1975 - Sep. 1976
D. V. Thomas, ed. and Joan Perry, E., ed. 1977 71 p refs
Avail: NTIS HC A04/MF A01; Roy. Greenwich Obs., Herstmonceux, Engl. £1

Various sections deal with national facilities, astronomical

research, national and international services, internal services, and public relations. ESA

N78-11900# Palermo Univ. (Italy). Lab. di Fisica Cosmica e Tecnologie Relative.
THE COS-B EXPERIMENT AND MISSION
L. Scarsi, K. Bennett, G. F. Bignami, G. Boella, R. Buccheri, W. Hermsen, L. Koch, H. A. Mayer-Hasselwander, J. A. Paul, E. Pfeffermann et al *In* ESA Recent Advan. In Gamma-Ray Astronomy Jul. 1977 p 3-11 refs Prepared jointly with Huygens Lab., Milan Univ., MaxPlanck-Inst. fuer Extraterrestrische Phys., Garching, West Ger., CEA, Saclay, France, and ESRTC, Noordwijk, Neth. (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11914*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA-RAY ASTRONOMY IN THE MEDIUM ENERGY (10-50 MeV) RANGE
D. A. Kniffen, D. L. Bertsch, D. J. Morris (Maryland Univ., College Park), R. A. R. Palmeira (Inst. de Pesquisas Espacias, Sao Paulo, Brazil), and K. R. Rao (Inst. de Pesquisas Espacias, Sao Paulo, Brazil) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 117-124 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01 CSCL 03B

N78-11932# Catholic Univ. of America, Washington, D. C.
A HYBRID MULTIWIRE PROPORTIONAL-DRIFT CHAMBER FOR USE IN GAMMA-RAY ASTRONOMY
H. Crannell and G. S. Maurer *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 243-248 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11933# European Space Research and Technology Center, Noordwijk (Netherlands).
A NEW DETECTOR FOR GAMMA-RAY ASTRONOMY
S. P. McKechnie, K. Bennett, A. vanDordrecht, and D. Ramsden (Southampton Univ., Engl.) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 249-256 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11934# Commissariat a l'Energie Atomique, Saclay (France).
AGATHE: A ONE SQUARE METER GAMMA-RAY SPARK CHAMBER BALLOON TELESCOPE WITH LOW ENERGY THRESHOLD AND HIGH ANGULAR ACCURACY
B. Parlier, B. Agrinier, E. Bonfand, E. Mougin, A. Lecomte, J. Andrejol, J. C. Courtois, J. M. Lavigne (Centre d'Etude Spatiale des Rayonnements), M. Niel (Centre d'Etude Spatiale des Rayonnements), G. Vedrenne (Centre d'Etude Spatiale des Rayonnements) et al *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 257-261 refs Sponsored by CNES (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11935# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
SOVIET-FRENCH INVESTIGATIONS IN GAMMA-RAY ASTRONOMY
In ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 263-268 refs Prepared jointly with CEA, Saclay, France, Inst. of Space Res., Moscow, Inst. of Eng. Phys., Moscow, Phys.-Tech. Inst., Leningrad, and Inst. of Phys., Moscow (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11936# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
THE SOVIET-FRENCH EXPERIMENT 'GAMMA I' FOR HIGH ENERGY GAMMA-RAY ASTRONOMY
R. Bazer-Bachi, F. Cottin, J. M. Lavigne, P. Mandrou, V. Akimov (Acad. of Sci., Moscow), M. Dobriyan (Acad. of Sci., Moscow), M. Fradkin (Acad. of Sci., Moscow), L. Kalinkin (Acad. of Sci., Moscow), V. Nesterov (Acad. of Sci., Moscow), S. Tabaldeiev (Acad. of Sci., Moscow) et al *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 269-275 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11937# Institute of Engineering Physics, Moscow (USSR).
APPLICATION OF SCINTILLATION TIME-OF-FLIGHT POSITION-SENSITIVE DETECTOR SYSTEMS FOR GAMMA-RAY TELESCOPES OF LARGE AREA
V. G. Bondarenko, A. M. Galper, V. A. Grigoriev, A. A. Koliubin, E. F. Makliaev, and I. S. Markina *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 277-278 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11938# Mount Hopkins Observatory, Amado, Ariz. Center for Astrophysics.
GAMMA-RAY ASTRONOMY FROM 10-100 GeV: A NEW APPROACH
T. C. Weekes and K. E. Turver (Durham Univ., Engl.) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 279-286 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11941# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
THE MPI IMAGING DOUBLE COMPTON TELESCOPE FOR OBSERVATIONS OF MeV GAMMA RADIATION
F. Graml, F. P. Penningsfeld, and V. Schoenfelder *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 301-307 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11942# Palermo Univ. (Italy). Lab. di Fisica Cosmica e Tecnologie Relative.
PULSAR SEARCH IN THE GAMMA-RAY ENERGY RANGE AND EVALUATION OF THE PULSAR RELEVANT PARAMETERS
R. Buccheri, N. DAmico, L. Scarsi, G. Kanbach (Max-Planck-Inst. fuer Extraterrestrische Phys., Garching, West Ger.), and J. L. Masnou (CEA, Saclay, France) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 309-316 refs Partly sponsored by Comitato Regionale Siciliano Ric. Nucl. (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11945 Imperial Coll. of Science and Technology, London (England).
ASSESSMENT OF BACKGROUND RADIATION EFFECTS IN LOW ENERGY GAMMA-RAY ASTRONOMY
C. S. Dyer *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 327-338 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N78-11959*# Grambling State Univ., La. Dept. of Chemistry.
A THEORETICAL INVESTIGATION OF ISOTOPIC ANOMALIES OF XENON IN TERRESTRIAL AND EXTRATERRESTRIAL SAMPLES Final Technical Report, 1972 - 1977
D. D. Sabu 1 Jul. 1977 6 p refs
(Grant NGR-19-011-012; NASA-CR-155255) Avail: NTIS HC A02/MF A01 CSCL 03B

The abundance and isotopic composition of noble gases in meteorites is discussed in relation to the composition of the early solar system. Carbonaceous chondrites contain a unique Xenon-X, which is rich in heavy and light isotopes. Variations in the occurrence of type-X and type-Y (the normal component) noble gases are of such magnitude that neither the injection of material from a nearby supernova nor presence of presolar grains can account for the anomalies in meteorites. Therefore, it is

suggested that the entire solar system may have condensed from the debris of a single local supernova. Author

N78-11926*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA RAYS AND THE CASE FOR BARYON SYMMETRIC BIG-BANG COSMOLOGY
F. W. Stecker *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 201-206 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01 CSCL 03B

N78-11927# European Space Research and Technology Center, Noordwijk (Netherlands).
THE GAMMA-RAY LUMINOSITY OF SPIRAL GALAXIES, ITS EVOLUTION AND ITS CONTRIBUTION TO THE DIFFUSE BACKGROUND ABOVE 100 MeV
G. G. Lichti, G. F. Bignami (Milan Univ.), and J. A. Paul (CEA, Saclay, France) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 207-210 refs Partly sponsored by ESA (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11931# Commissariat a l'Energie Atomique, Saclay (France).
COS-B AND COSMOLOGY
T. Montmerle *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 235-239 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N78-11960*# National Aeronautics and Space Administration, Washington, D. C.
THE LUNAR NOMENCLATURE: THE REVERSE SIDE OF THE MOON (1961-1973)
K. Shingareva and G. Burba Aug. 1977 111 p refs Transl. into ENGLISH from "Lunnaya Nomenklatura: Obratnaya Storona Luny 1961 - 1973", Moscow, Acad. of Sci. of the USSR, 1977 p 1-56 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75035) Avail: NTIS HC A06/MF A01 CSCL 03B

The history of naming the details of the relief on the near and reverse sides of the moon is examined. The book contains lists of the names of craters of the reverse side of the moon in Russian and the Latin spellings. Author

N78-11961*# National Aeronautics and Space Administration, Washington, D. C.
EARLY STAGES IN THE EVOLUTION OF THE ATMOSPHERE AND CLIMATE ON THE EARTH-GROUP PLANETS
V. I. Moroz and L. M. Mukhin Oct. 1977 39 p refs Transl. into ENGLISH of "O Rannivkh Ėtapakh Evolyutsii Atmosfery i Klimata Na Planetakh Zemnoy Gruppy", Rept. Pr-337 Inst. of Space Res., Acad. of Sci. USSR, Moscow, 1977 p 1-50 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75054; PR-337) HC A03/MF A01 CSCL 03B

The early evolution of the atmospheres and climate of the Earth, Mars and Venus is discussed, based on a concept of common initial conditions and main processes (besides known differences in chemical composition and outgassing rate). It is concluded that: (1) liquid water appeared on the surface of the earth in the first few hundred million years; the average surface temperature was near the melting point for about the first two eons; CO2 was the main component of the atmosphere in the first 100-500 million years; (2) much more temperate outgassing and low solar heating led to the much later appearance of liquid water on the Martian surface, only one to two billion years ago; the Martian era of rivers, relatively dense atmosphere and warm climate ended as a result of irreversible chemical bonding of CO2 by Urey equilibrium processes; (3) a great lack of water in the primordial material of Venus is proposed; liquid water never was present on the surface of the planet, and there was practically no chemical bonding of CO2; the surface temperature was over 600 K four billion years ago. Author

N78-11962*# Lunar Science Inst., Houston, Tex.
PAPERS PRESENTED TO THE CONFERENCE ON LUNA 24
1977 220 p refs Conf. held at Houston, Tex., 1-3 Dec. 1977
(Contract NSR-09-051-001)
(NASA-CR-154527; LSI-Contrib-304) Avail: NTIS HC A10/MF A01 CSCL 03B

Topics covered include: the regional geology, geochemistry, and geophysics of Mare Crisium and the Luna 24 landing site; the petrology, mineral chemistry, and cooling histories of lithic fragments, the chemistry, isotopic studies, and geochronology of Luna 24 samples; and regolith studies of soil samples. Subject and topical indexes are provided. A.R.H.

N78-11963*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MARINER 10 MAGNETIC FIELD OBSERVATIONS OF THE VENUS WAKE
R. P. Lepping and K. W. Behannon Aug. 1977 50 p refs Submitted for publication
(NASA-TM-78036; X-695-77-206) Avail: NTIS HC A04/MF A01 CSCL 03B

Magnetic field measurements made over a 21-hour interval during the Mariner 10 encounter with Venus were used to study the down-stream region of the solar wind-Venus interaction over a distance of approximately 100 R sub v. For most of the day before closest approach the spacecraft was located in a sheath-like region which was apparently bounded by planetary bow shock on the outer side and either a planetary wake boundary or transient boundary-like feature on the inner side. The spacecraft made multiple encounters with the wake-like boundary during the 21-hour interval with an increasing frequency as it approached the planet. Each pass into the wake boundary from the sheath region was consistently characterized by a slight decrease in magnetic field magnitude, a marked increase in the frequency and amplitude of field fluctuations, and a systematic clockwise rotation of the field direction when viewed from above the plane of the planet orbit. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N78-11964# National Oceanic and Atmospheric Administration, Boulder, Colo.
A STUDY OF THE CAPABILITY FOR RAPID WARNINGS OF SOLAR FLARE RADIATION HAZARDS TO AIRCRAFT. PART 1: FORECASTS AND WARNINGS OF SOLAR FLARE RADIATION HAZARDS. PART 2: AN FAA POLAR FLIGHT SOLAR COSMIC RADIATION FORECAST/WARNING COMMUNICATION SYSTEM STUDY
Herbert H. Sauer and Garth H. Stonehocker Apr. 1977 88 p
(Contract DOT-FA72WAI-320)
(PB-270284/3; NOAA-TM-ERL-sel-46-Pt-1) Avail: NTIS HC A05/MF A01 CSCL 03B

Current procedures for forecasting solar activity and methods for verifying these forecasts are reviewed, as well as the radiation hazard program developed in support of the Concorde program. Available and future aeronautical telecommunication system facilities were analyzed to determine an optimum system for distributing forecasts to the preflight planning centers in the international flight service stations for polar-flying subsonic and supersonic transport type aircraft. Provisions for timely and reliable distribution of warnings to individual in-flight aircraft polar areas are also recommended for the system. GRA

N78-11965# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 393. PART 2: COMPREHENSIVE REPORTS. DATA FOR NOVEMBER 1976-OCTOBER 1976 AND MISCELLANEA
Helen E. Coffey May 1977 53 p
(PB-270310/6; SGD-393-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 03B

Predicted and observed solar and geophysical data for November 1976-October 1976 are presented in tables and graphs. The data include sunspot numbers, solar flux, solar flares and their effects, magnetic storms, and SID effects. Author

N78-11966# Texas Univ., El Paso. Dept. of Electrical Engineering.
HIGH-LATITUDE PHOTODISSOCIATION RATES AND PREDICTED SOLAR FLUX INTENSITIES. AN ADDENDUM TO STRATCOM-RELATED PHOTODISSOCIATION RATES AND SOLAR FLUX INTENSITIES
Jerry Collins Jul. 1977 32 p refs
(Contract DAAD07-74-C-0263)
(AD-A043593; SP15-77-UA-43; ECOM-77-5;
ECOM-77-1-Add) Avail: NTIS HC A03/MF A01 CSCL 04/1

Photodissociation rates and predicted solar flux intensities have been reported for conditions closely corresponding to those of the STRATCOM (STRATospheric COMposition) balloon launches. This brief addendum to that report extends the calculations to include rates and solar flux intensities predicted for 65.3 north latitude. This is the location of the U.S. Army's Meteorological Rocket Station at Poker Flat, Alaska, where it is possible that such correlated experiments as the STRATCOM balloon launches will be made in the future. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N78-11967*# National Aeronautics and Space Administration, Washington, D. C.
SOVIET-FRENCH WORKING GROUP INTERPRETATION OF THE SCIENTIFIC INFORMATION DURING THE SEARCH FOR CELESTIAL SOURCES OF GAMMA PULSES, ABSTRACT OF REPORTS, 24-30 MARCH 1977
I. V. Estulin Oct. 1977 15 p refs Transl. into ENGLISH of "Sovetsko-Frantsuzskiy Rabochiy Seminar Interpretatsiya Nauchnoy Informatsii pri Poiske Nebesnykh Istochnikov Gamma-Vspleskov" Moscow, Acad. of Sci. USSR, Inst. of Space Res., 1977 p 1-16 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75050) Avail: NTIS HC A02/MF A01 CSCL 03B

The progress made and techniques used by the Soviet-French group in the study of gamma and X ray pulses are described in abstracts of 16 reports. Experiments included calibration and operation of various recording instruments designed for measurements involving these pulses, specifically the location of sources of such pulses in outer space. Space vehicles are utilized in conjunction with ground equipment to accomplish these tests. Author

N78-11968*# National Aeronautics and Space Administration, Washington, D. C.
A GAMMA-RAY TESTING TECHNIQUE FOR SPACECRAFT
B. S. Gribov, N. N. Repin, V. A. Sakovich, and V. M. Sakharov Oct. 1977 7 p refs Transl. into ENGLISH from KOSM. Issled. (USSR), v. 15, no. 3, 1977 p 491-493 Original language document was announced as A77-38672 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75053) Avail: NTIS HC A02/MF A01 CSCL 03B

The simulated cosmic radiation effect on a spacecraft structure is evaluated by gamma ray testing in relation to structural thickness. A drawing of the test set-up is provided and measurement errors are discussed. Author

N78-11969# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 393. PART 1: PROMPT REPORTS. DATA FOR APRIL 1977 - MARCH 1977
Helen E. Coffey May 1977 126 p
(PB-270309/8; SGD-393-Pt-1) Avail: NTIS HC A07/MF A01 CSCL 03B

Predicted and observed solar and geophysical data for April 1977 are presented in tables and graphs. The data include sunspot numbers, solar flux, solar flares and their effects, magnetic storms, and SID effects. Author

N78-11901# Huygens Laboratium, Leiden (Netherlands).
COS-B OBSERVATIONS OF LOCALISED GAMMA-RAY EMISSION
W. Hermsen, K. Bennett, G. F. Bignami, G. Boella, R. Buccheri, J. C. Higdon, G. Kanbach, G. G. Lichti, J. L. Masnou, H. A. Mayer-Hasselwander et al *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 13-20 refs Prepared jointly with Milan Univ., Palermo Univ., Italy, Max-Planck-Inst. fuer Extraterrestrische Phys., Garching, West Ger., CEA, Saclay, France, and ESRTC, Noordwijk, Neth. (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11902# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
COS-B RESULTS ON A SEARCH FOR PULSED GAMMA-RAY EMISSION FROM RADIO PULSARS
G. Kanbach, K. Bennett, G. F. Bignami, G. Boella, M. Bonnardeau, R. Buccheri, N. DAmico, W. Hermsen, J. C. Higdon, G. G. Lichti et al *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 21-32 refs Prepared jointly with Huygens Lab., Milan Univ., Palermo Univ., Italy, CEA, Saclay, France, and ESRTC, Noordwijk, Neth. (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11903# Commissariat a l'Energie Atomique, Saclay (France). Service D'Electronique Physique.
SEARCH FOR GAMMA-RAY TIME VARIABILITY OF CYGNUS X-3 AND CG 195+4
J. L. Masnou, K. Bennett, G. F. Bignami, R. Buccheri, P. Caraveo, N. DAmico, W. Hermsen, G. Kanbach, G. G. Lichti, H. A. Mayer-Hasselwander et al *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 33-37 refs Prepared jointly with Huygens Lab., Milan Univ., Palermo Univ., Italy, Max-Planck-Inst. fuer Extraterrestrische Phys., Garching, West Ger., and ESRTC, Noordwijk, Neth. (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11904# Mount Hopkins Observatory, Amado, Ariz. Center for Astrophysics.
OBSERVATIONS OF THE 100 MeV GAMMA-RAY SOURCES AT ENERGIES OF 100-1000 G EV
T. C. Weekes and H. F. Helmken *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 39-43 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11905*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAS-2 OBSERVATIONS OF HIGH ENERGY GAMMA RAYS FROM DISCRETE SOURCES
D. A. Kniffen, C. E. Fichtel, R. C. Hartman, R. C. Lamb, and D. J. Thompson *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 45-53 refs (For availability see N78-11899 02-99)
Avail: NTIS HC A17/MF A01

N78-11906# Center for Astrophysics, Cambridge, Mass.
RESULTS OF THE MOUNT HOPKINS SKY SURVEY FOR SOURCES OF 100-1000 GeV GAMMA RAYS
T. C. Weekes, H. F. Helmken, J. E. Grindlay, and E. Horine *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 55-58 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11907# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
OBSERVATIONS OF CYG X-1 AND THE CRAB NEBULA IN THE 100 keV -4 MeV ENERGY RANGE
P. Mandrou, M. Niel, and G. Vedrenne *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 59-66 refs (For availability see N78-11899 02-88)
(Contract CNES-BA-01-02-F)
Avail: NTIS HC A17/MF A01

N78-11908*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF CELESTIAL X-RAY SOURCES ABOVE 20 kEV WITH THE HIGH-ENERGY SCINTILLATION SPECTROMETER ON BOARD OSO-8
C. J. Crannell, B. R. Dennis, J. F. Dolan, K. J. Frost, L. E. Orwig, J. H. Beall (Maryland Univ., College Park), and G. S. Maurer (Catholic Univ, of America) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 67-73 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11909# Palermo Univ. (Italy).
GAMMA-RAY PULSARS: IMPLICATIONS FOR THE RADIATION MECHANISM
E. Massaro and M. Salvati (Lab. di Astrofis. Spaziale) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 75-79 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11910# European Space Research and Technology Center, Noordwijk (Netherlands).
COS-B OBSERVATIONS OF GALACTIC GAMMA-RAY EMISSION (LARGE-SCALE)
K. Bennett, G. F. Bignami, R. Buccheri, W. Hermsen, G. Kanbach, F. Lebrun, H. A. Mayer-Hasselwander, J. A. Paul, G. Piccinotti, L. Scarsi et al *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 83-93 refs Prepared jointly with Huygens Lab., Milan Univ., Palermo Univ., Max-Planck-Inst. fuer Extraterrestrische Phys., Garching, West Ger., and CEA, Saclay, France (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11911*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAS-2 GAMMA-RAY RESULTS FROM THE GALACTIC PLANE AND THEIR IMPLICATIONS FOR GALACTIC STRUCTURE AND GALACTIC COSMIC-RAY DYNAMICS
C. E. Fichtel, D. A. Kniffen, and D. J. Thompson *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 95-104 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01 CSCL 03B

N78-11912# Milan Univ. (Italy). Lab. di Fisica Cosmica e Tecnologie Relative.
GAMMA RAYS FROM ACCRETING BLACK HOLES
L. Maraschi and A. Treves *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 105-106 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11913# Naval Research Lab., Washington, D. C.
OBSERVATIONS OF GAMMA RADIATION FROM THE GALACTIC CENTER REGION
G. H. Share, R. L. Kinzer, J. Samimi (Ferdowsi, Univ., Mashhad, Iran), and A. Jabbari-Azad (Ferdowsi Univ., Mashhad, Iran) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 107-115 refs Partly sponsored by the Office of Naval Res., Ferdowsi Univ. and the Iranian Min. of Sci. and Higher Educ. (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11915# Milan Univ. (Italy). Lab. di Fisica Cosmica e Tecnologie Relative.
GALACTIC MEDIUM ENERGY GAMMA-RAY ASTRONOMY: A QUANTITATIVE STUDY OF THE INVERSE COMPTON CONTRIBUTION
G. Piccinotti and G. F. Bignami *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 125-130 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11916# Commissariat a l'Energie Atomique, Saclay (France).
BREMSSTRAHLUNG GAMMA RADIATION FROM THE GALAXY
P. G. Shukla and C. J. Cesarsky *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 131-136 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11917# Kiel Univ. (West Germany).
A NEW TEST FOR THE ORIGIN OF GALACTIC GAMMA RAYS
R. Schlickeiser and K. O. Thielheim *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 139-145 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11918# Durham Univ. (England).
PROPAGATION OF COSMIC-RAY PRIMARY AND SECONDARY ELECTRONS IN DENSE INTERSTELLAR CLOUDS, AND IMPLICATIONS FOR GAMMA-RAY PRODUCTION
A. W. Strong and J. Skilling (Cambridge Univ., Engl.) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 147-151 refs Partly sponsored by the Commissioners for the Exhibition of 1851 (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11919# Commissariat a l'Energie Atomique, Saclay (France).
COSMIC-RAY PENETRATION INTO MOLECULAR CLOUDS
C. J. Cesarsky and H. J. Voelk (Max-Planck-Inst. fuer Kernphys.) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 153-156 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11920# Durham Univ. (England).
GRADIENT OF COSMIC RAYS TOWARDS THE GALACTIC CENTRE
A. W. Wolfendale and E. C. M. Young (Hong Kong Univ.) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 157-160 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11921# Durham Univ. (England).
GAMMA RAYS FROM COSMIC RAYS IN THICK TARGETS AND APPLICATION IN THE GALACTIC 300pC H2 RING
A. W. Wolfendale and D. M. Worrall *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 161-165 refs Partly sponsored by Sci. Res. Council (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11922# Durham Univ. (England).
GAMMA RAYS AND THE COSMIC-RAY GRADIENT AWAY FROM THE GALACTIC CENTRE
A. W. Strong, A. W. Wolfendale, K. Bennett (ESRTC, Noordwijk, Neth.), and R. D. Wills (ESRTC, Noordwijk, Neth.) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 167-170 refs Partly sponsored by the Commissioners for the Exhibition of 1851 (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11923*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GALACTIC GAMMA RAYS AND THE COSMIC-RAY HALO PROBLEM
F. W. Stecker and F. C. Jones *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 171-177 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01 CSCL 03B

N78-11924*# Imperial Coll. of Science and Technology, London (England).
REANALYSIS OF THE APOLLO COSMIC GAMMA-RAY SPECTRUM IN THE 0.3 TO 10 MeV ENERGY REGION
C. S. Dyer, J. I. Trombka (NASA Goddard Space Flight Center,

Greenbelt, Md.), L. G. Evans (Computer Sci. Corp.), M. J. Bielefeld (Computer Sci. Corp.), S. M. Selzer (NBS, Washington, D.C.), and A. E. Metzger (JPL, Pasadena) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 181-189 refs (For availability see N78-11899 02-88)
(Grant NGL-21-002-033)
Avail: NTIS HC A17/MF A01 CSCL 03B

N78-11925*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CELESTIAL DIFFUSE GAMMA-RAY EMISSION OBSERVED BY SAS-2 AND ITS INTERPRETATION
C. E. Fichtel, D. A. Kniffen, R. C. Hartman, D. J. Thompson, H. Gelman (Middle East Tech. Univ.), M. Ozel (Middle East Tech. Univ.), and T. Tumer (Middle East Tech. Univ.) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 191-200 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01 CSCL 03B

N78-11928*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA-RAYS FROM THE DE-EXCITATION OF 12C*(15.11 MeV) AND 12C*(4.44 MeV) AS PROBES OF ENERGETIC PARTICLE SPECTRA
C. J. Crannell, R. Ramaty (Catholic Univ. of America), and H. Crannell *In* ESA Recent Advan. In Gamma-Ray Astronomy Jul. 1977 p 213-217 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01 CSCL 03B

N78-11929# Kiel Univ. (West Germany).
CRITICAL REEXAMINATION OF ELECTROMAGNETIC GAMMA-RAY SOURCE FUNCTIONS
R. Schlickeiser and K. O. Thielheim *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 219-224 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11930# Commissariat a l'Energie Atomique, Saclay (France).
LIGHT ELEMENT PRODUCTION BY COSMOLOGICAL COSMIC RAYS AND THE GAMMA-RAY BACKGROUND
T. Montmerle *In* ESA Recent Advan. in Gamma-Ray Astronomy 1977 p 225-234 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11943# University Coll., Dublin (Ireland).
POSSIBLE NEW METHODS OF DETECTING COSMIC-RAY ELECTRONS BY THEIR SYNCHROTRON RADIATION IN THE GEOMAGNETIC FIELD AND INTERSTELLAR MAGNETIC FIELD
B. McBreen *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 319-321 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11947# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
THEORETICAL ZENITH ANGLE DISTRIBUTION OF ATMOSPHERIC MeV GAMMA RADIATION AT HIGH BALLOON ALTITUDES
U. Graser and V. Schoenfelder *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 343-350 refs (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

N78-11950*# Naval Research Lab., Washington, D. C.
SPECTRA OF COSMIC GAMMA-RAY BURSTS IN THE HARD X-RAY RANGE
G. H. Share and S. R. Kane (Calif. Univ., Berkeley) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 365-373 refs Submitted for publication (For availability see N78-11899 02-88)
(Grant NGL-05-003-017)
Avail: NTIS HC A17/MF A01 CSCL 03B

N78-11951# Center for Astrophysics, Cambridge, Mass.
A SEARCH FOR GAMMA-RAY BURSTS FROM THE EXPLOSIVE EVAPORATION OF BLACK HOLES
T. C. Weekes and N. A. Porter (Univ. Coll., Dublin) *In* ESA Recent Advan. in Gamma-Ray Astronomy Jul. 1977 p 375-378 refs Partly sponsored by Smithsonian Res. Found. and Natl. Sci. Council of Ireland (For availability see N78-11899 02-88)
Avail: NTIS HC A17/MF A01

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N78-11970# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1976-4
Jul. 1977 153 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-4, Jul.-Aug. 1976 p 183-250 Original French report available from ONERA, Paris FF 30
(ESA-TT-396) Avail: NTIS HC A08/MF A01

Topics are presented in the fields of aerodynamics and materials. The following subjects are discussed: turbulent boundary layer in a pulsating flow, specific heat and electronic structure of compounds and alloys of transition metals, ion microanalysis of superalloy protective coatings, active flutter suppression system, CERT T2 injector driven wind tunnel, and directional effect of first half cycle in low cycle fatigue. For individual titles, see N78-11971 through N78-11976.

N78-11971# European Space Agency, Paris (France).
EXPERIMENTAL ANALYSIS OF THE CHARACTERISTICS OF A TURBULENT BOUNDARY LAYER IN A PULSATING FLOW. AN ATTEMPT AT THEORETICAL PREDICTION **c34**
Robert Houdeville, Andre Desopper, and Jean Cousteix *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-4 (ESA-TT-396) Jul. 1977 p 1-20 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-4, Jul.-Aug. 1976 p 183-191 Original report in FRENCH previously announced as A77-11156 (For availability see N78-11970 02-99)
Avail: NTIS HC A08/MF A01

An unsteady turbulent boundary layer, on the floor of a subsonic wind tunnel in which a sinusoidally fluctuating free stream was generated, was investigated. In the boundary layer an average velocity was determined as an ensemble average over a great number of cycles for instants in phase in the period. The longitudinal component of turbulence was studied by the determination of its statistical distribution and root mean square. A calculation method based on the resolution of transport equation for the turbulent kinetic energy and its dissipation is presented. Results are compared with experimental data. Author (ESA)

N78-11972# European Space Agency, Paris (France).
SPECIFIC HEAT AND ELECTRONIC STRUCTURE OF COMPOUNDS AND ALLOYS OF TRANSITION METALS **c26**
Rene Caudron and Paul Costa *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-4 (ESA-TT-396) Jul. 1977 p 21-78 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-4, Jul.-Aug. 1976 p 193-215 Original report in FRENCH previously announced as A77-11157 (For availability see N78-11970 02-99)
Avail: NTIS HC A08/MF A01

Specific heat measurements are often an essential element of studies on electronic structure or magnetism and, in this respect, are of utmost interest in the case of metals, alloys, and compounds of transition elements. A review is presented of work performed at ONERA in this field, related to transition metal carbides, nitrides, borides, and hydrides; to ordered compounds of the NiAl and TiNi families; and to dilute alloys of transition metals or carbon in a nickel matrix (or dissolved in a NiCo or a NiFe matrix); as well as on the specific heat properties in several systems (CoAl, FeAl, MoFe, invar alloys, almost magnetic alloys), in relation to their magnetic properties. Author (ESA)

N78-11973# European Space Agency, Paris (France).
APPLICATION OF ION MICROANALYSIS TO THE STUDY OF PROTECTIVE COATING ON SUPERALLOYS **c26**

Guy Thauvin, Claude Roques-Carmes, Guy Blaise, Georges Slodzian, and Robert Pichoir *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-4 (ESA-TT-396) Jul. 1977 p 79-116 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-4, Jul.-Aug. 1976 p 217-232 Original report in FRENCH previously announced as A77-11158 (For availability see N78-11970 02-99)
Avail: NTIS HC A08/MF A01

Superalloy protective coatings have a complex structure constituted by the NiAl compound containing most of the alloying elements of the substrate in solid solution along with numerous precipitates. Ion microanalysis was used as a method of analysis and location of different elements in these coatings. Some general features of this method are described, and it is shown how the problems of mass superposition and detection of secondary ions are resolved in the particular case considered. The use of secondary ion emission made it possible to establish the validity of previously obtained results; it further permitted the location of yttrium, the detection and location of boron, and the differentiation of various carbides and carbonitrides. Author (ESA)

N78-11974# European Space Agency, Paris (France).
WIND TUNNEL STUDY OF AN ACTIVE FLUTTER SUPPRESSION SYSTEM **c08**
Roger Destuynder *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-4 (ESA-TT-396) Jul. 1977 p 117-134 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-4, Jul.-Aug. 1976 p 233-241 Original report in FRENCH previously announced as A77-11159 (For availability see N78-11970 02-88)
Avail: NTIS HC A08/MF A01

Active flutter control was experimented in a wind tunnel on a model of wing carrying an external tank. The aerodynamic forces of the control system were generated by a classical aileron, piloted by a miniaturized servo-control from a signal issued by an accelerometer detecting the wing movement. A single control law was used in the whole velocity range. A gain of more than 15% was obtained on the flutter critical velocity. Author (ESA)

N78-11975# European Space Agency, Paris (France).
PERFORMANCE AND FLOW QUALITY OF THE CERT T2 INJECTOR DRIVEN TUNNEL **c09**
Andre Mignosi and Claude Quemard *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-4 (ESA-TT-396) Jul. 1977 p 135-140 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-4, Jul.-Aug. 1976 p 243-245 Original report in FRENCH previously announced as A77-11160 (For availability see N78-11970 02-88)
Avail: NTIS HC A08/MF A01

Continued tests are reported on the T2 injector-driven wind tunnel, of 40 x 40 cm working section, which is a 1/10 scale model of a planned transonic, high Re-number wind tunnel. It was found that at Mach numbers in the range 0.6 to 0.9, increasing the ratio of areas of the mixer section and the injection section from 20 to 29 results in a gain in the ratio of flow crossing the working section to injected flow from 7 to 8. Aerodynamic qualities were examined by measuring pressure fluctuations at the wall and velocity fluctuations in the relaxation chamber. The use of a second neck resulted in considerable attenuation of low frequency noise. The increased area ratio of 29 also resulted in more stable performance. Author (ESA)

N78-11976# European Space Agency, Paris (France).
INFLUENCE OF THE DIRECTION OF THE FIRST HALF-CYCLE IN LOW-CYCLE FATIGUE **c39**
Georges Vidal and Jean-Louis Bernard *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-4 (ESA-TT-396) Jul. 1977 p 141-149 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-4, Jul.-Aug. 1976 p 247-250 Original report in FRENCH previously announced as A77-11161 (For availability see N78-11970 02-88)
Avail: NTIS HC A08/MF A01

Low-cycle symmetric alternating tension-compression tests at high applied stresses were performed on an aluminum alloy in order to ascertain the influence on time to fracture of the direction in which the tests were begun - whether in tension or compression. The Woehler curves correspond to two fracture mechanisms. In the first, up to 100 cycles to fracture, the stress-strain cycle is open and unstable, and the residual elongations accumulate to the point of causing static fracture. In the second, beyond about 200 cycles, the stress-strain cycle closes and stabilizes, and classic fatigue cracks appear. Starting in tension led in all cases to a lower number of cycles to failure than starting in compression. Author (ESA)

N78-11977# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1976-3
Nov. 1976 144 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-3, May - Jun. 1976 p 127-186 Original French report available from ONERA, Paris FF 30
(ESA-TT-356) Avail: NTIS HC A07/MF A01

The following topics are discussed: boundary layer flow analysis using hot film detectors in subsonic and transonic flow, aerothermal study of flow through a duct with perforated walls for gas turbine engine cooling, tungsten chemical vapor deposition for fabrication of cesium ion emitters for electrostatic thrustors, in situ investigation of plastic deformation mechanisms by high voltage microscopy, a new method for calculating satellite ephemerides for laser tracking systems, and the amplification of flow distortion in an axial compressor stage. For individual titles, see N78-11978 through N78-11983.

N78-11978 European Space Agency, Paris (France).
BOUNDARY LAYER STUDY BY HOT FILM DETECTORS IN SUBSONIC AND TRANSONIC FLOW **c34**
Claude Armand *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-3 (ESA-TT-356) Nov. 1976 p 1-16 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-3, May - Jun. 1976 p 127-133 (For availability see N78-11977 02-99)
Avail: NTIS HC A07/MF A01

The nature of the boundary layer at the surface of a body in subsonic or transonic flow conditions and the direction of flow at the wall are determined by using surface detectors with two small hot films; interpretation of the results obtained are described for the case of wind tunnel tests on fixed wings. The level and form of the signal appearing on a cathode-ray oscilloscope provide sure and easy real time identification of the boundary layer surrounding the detector, whether this flow is laminar, in transition, turbulent, or separated. The direction of flow is established, with an accuracy of the order of one degree, at angles of between -30 deg and +30 deg between the flow direction and the detector centerline. The very short response time of this type of detector means that it can be used in unsteady flow conditions (oscillating profiles, rotating wings, turbomachines). Author (ESA)

N78-11979# European Space Agency, Paris (France).
AEROTHERMAL STUDY OF THE FLOW THROUGH A DUCT WITH PERFORATED WALLS **c34**
Emile LeGrives and Jeanne Genot *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-3 (ESA-TT-356) Nov. 1976 p 17-49 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-3, May - Jun. 1976 p 135-147 Original report in FRENCH previously announced as A76-41126 (For availability see N78-11977 02-99)
Avail: NTIS HC A07/MF A01

Within the framework of research on air cooling of gas turbine elements, results are presented that were obtained first by hydrodynamic visualizations, in the case of two-dimensional configurations allowing a comparison with analytical solutions of the potential flow field, then on an experimental set up of three-dimensional configuration. Pressure and stagnation temperature micro-probings at the outlet of a row of holes throw some light on the distribution of the flow introduced into a duct with perforated walls, as well as on the pressure drop and thermal transfer coefficient along the wall. Sensitive to the effect of flow shear at the orifice inlet, the Stanton numbers deduced from the measurements are higher than predicted by the classical correlation rules. Author (ESA)

N78-11980# European Space Agency, Paris (France).
A NEW TECHNIQUE FOR THE FABRICATION OF CESIUM ION EMITTERS FOR ELECTROSTATIC THRUSTERS **c20**

Arvind Shroff, Andre Hivert, and Jean Labbe *In its* La Rech. Aerospatiale, Bi-monthly Bull. no. 1976-3 (ESA-TT-356) Nov. 1976 p 50-66 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-3, May - Jun. 1976 p 149-155 Original report in FRENCH previously announced as A76-41127 (For availability see N78-11977 02-99)
HC A07/MF A01

A new joining process for tungsten porous materials was used to manufacture cesium ion emitters suitable for electrostatic thrusters. This method uses tungsten chemical vapor deposition. First tests, including metallographic analysis, thermal study, and ionizing capability measurements, demonstrated that, apart from minor deficiencies, this process was particularly promising. Coupled with the manufacturing technique of thoriated tungsten porous materials, this method allows the fabrication of new component parts which is very difficult when one resorts to the classical process of electron beam welding. Author (ESA)

N78-11981# European Space Agency, Paris (France).
HIGH VOLTAGE ELECTRON MICROSCOPY. IN SITU INVESTIGATION OF PLASTIC DEFORMATION MECHANISMS c24
Roger Valle *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-3 (ESA-TT-356 Nov. 1976 p 67-100 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-3, May - Jun. 1976 p 157-170 Original report in FRENCH previously announced as A76-41128 (For availability see N78-11977 02-99)
Avail: NTIS HC A07/MF A01

The fact that thicker foils can be observed in a high voltage electron microscope has led to the development of in situ tensile experiments. In order to take full advantage of this possibility a side-entry straining stage was designed to fit the goniometer stage of the 1.2 MV CNRS-ONERA microscope. Plastic deformation mechanisms in tension of a unidirectionally-solidified, metal matrix, carbide-reinforced fiber composite ware studied under the microscope. This technique was particularly suitable for observing dislocation pile-ups against the fibers during the initial stage of plastic deformation. The dislocation configurations were found in perfect accordance with previous observations on bulk material. A theoretical analysis of the observed dislocation pile-ups led to an unambiguous determination of the deformation modes of such a composite. Author (ESA)

N78-11982# European Space Agency, Paris (France).
A NEW METHOD OF CALCULATING SATELLITE EPHEMERIDES FOR LASER TRACKING SYSTEMS c13
Michel Staron and Didier Vasseur *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-3 (ESA-TT-356) Nov. 1976 p 101-132 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-3, May - Jun. 1976 p 171-182 Original report in FRENCH previously announced as A76-41129 (For availability see N78-11977 02-99)
Avail: NTIS HC A07/MF A01

A new method for calculating satellite ephemerides above an observation station was developed. Applicable to any satellite tracking systems, it is particularly convenient for laser rangefinding stations. It is based on the 'two-centers' theory and the perturbed Keplerian movement, and its principle can be summarized as follows: knowing the six osculating parameters of the orbit at rendezvous time T sub 0, the satellite ephemerides are calculated at times T sub 1 by assimilating its orbit between T sub 0 and T sub 1 to a fictitious Keplerian movement relative to an attraction center. For a 20,000 minute passage this method, which makes do with a single set of osculating parameters, ensures a precision of 200 to 300 m on the distance and of 2 arc-minutes on angles as compared with the complete prediction calculation. Used in Oct. 1975 during the operation of laser trajectography on the GEOS-C, D5B, and Starlette satellites, this new method, which noticeably simplifies the operators' work, gave satisfactory results. Details of the procedures useful for the understanding and implementation of the method are given. Author (ESA)

N78-11983# European Space Agency, Paris (France).
AMPLIFICATION OF DISTORTIONS IN AN AXIAL COMPRESSOR STAGE c07
Lionel Ravet *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1976-3 (ESA-TT-356) Nov. 1976 p 133-140 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1976-3, May - Jun. 1976 p 183-185 Original report in FRENCH previously announced as A76-41130 (For availability see N78-11977 02-99)
Avail: NTIS HC A09/MF A01

Linear theory is used to study the steady-state flow in an axial compressor fed by a stream with low-amplitude azimuthal heterogeneity. It is shown that there exist critical conditions for which a perturbation of very low amplitude is multiplied thousands of times by interaction of the fixed and mobile blade grids. This amplification can occur only when there is coupling between the wheel and the diffuser which follows it and if there exist irreversibilities resulting from flow separation in the interblade channels. In this case, the equilibrium required for lateral readjustment of the streams with different energies can only be obtained by large modifications in velocity. This amplification effect is impossible in a perfect fluid. Author (ESA)

N78-11984# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE, BI-MONTHLY BULLETIN NO. 1977-1
Sep. 1977 143 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-1, Jan.-Feb. 1977 p 1-66 Original French report available from ONERA, Paris FF 30
(ESA-TT-407) Avail: NTIS HC A07/MF A01

The following topics are discussed: an integral method for calculating the turbulent boundary layer along a longitudinally curved wall, formation and development of recirculation bubbles in the core of a wake, autopyrolytic fuels for ramjets, flammability of heat resisting resins, and cast composite mirrors fo infrared reduction. A brief review is presented of the effect of overaging at 175 C on fatigue crack growth rate in 7075 Al alloy. For individual titles, see N78-11985 through N78-11990.

N78-11985# European Space Agency, Paris (France).
AN INTEGRAL METHOD FOR THE CALCULATION OF A TURBULENT BOUNDARY LAYER ALONG A LONGITUDINALLY CURVED WALL c34
Jean Cousteix and Robert Houdeville *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-1 (ESA-TT-407) Sep. 1977 p 1-32 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-1, Jan.-Feb. 1977 p 1-13 Original report in FRENCH previously announced as A77-27740 (For availability see N78-11984 02-99)
Avail: NTIS HC A07/MF A01

The effect of wall curvature on the development of turbulent boundary layers (TBL) and on localization of the point of separation of the layer was investigated. The mixing length concept was modified by incorporating data derived from transport equations for turbulent friction and kinetic energy. Similitude solutions were arrived at by using the integral method. The method was tested on incompressible TBL and was then extended to compressible flow without heat transfer at the curved wall, for moderate Mach numbers. Predictions of the position of the layer separation point constitute an important test. Author (ESA)

N78-11986# European Space Agency, Paris (France).
RECIRCULATION BUBBLES IN THE CORE OF A WAKE c34
Henri Werle and Jean-Louis Solignac *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-1 (ESA-TT-407) Sep. 1977 p 33-60 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-1, Jan.-Feb. 1977 p 15-30 Original report in FRENCH previously announced as A77-27741 (For availability see N78-11984 02-99)
Avail: NTIS

Formation and development of recirculation bubbles in a wind tunnel, and an experimental analysis of the recirculation zone formed in a turbulent wake at subsonic speeds are discussed. Wind tunnel visualizations are displayed in high-resolution glossy photographs. Swept bodies are right cylinders or streamlined bodies of revolution tapering to a rear-point. Wind tunnel mounting arrangements and flows in water or in air are discussed in detail. Full-laminar wakes and turbulent wakes, and sudden onset of wakes downstream of the tunnel model were studied, with attention paid to trailing-edge separation of flow. Author (ESA)

N78-11987# European Space Agency, Paris (France).
SOLID PROPELLANTS FOR RAMJETS: AUTO-PYROLYZING FUELS **c28**
L. Nadaud, F. Reynaud, and A. Moutet *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-1 (ESA-TT-407) Sep. 1977 p 61-79 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977- 1, Jan.-Feb. 1977 p 31-38 Original report in FRENCH previously announced as A77-27742 (For availability see N78-11984 02-99)
Avail: NTIS HC A07/MF A01

Oxidizer was mixed (in small proportions) with polymerizable binder such that energy generated through combustion of the oxidizer and a fraction of the fuel was used up almost totally in pyrolysis of the remaining binder, in an ONERA solution described. These solids are termed semipropellants, or self-pyrolyzing solid fuels. The performance qualities of these semipropellants were examined with emphasis on suitability for air-breathing propulsion plants. Author (ESA)

N78-11988# European Space Agency, Paris (France).
STUDY OF THE FLAMMABILITY OF HEAT RESISTING POLYMERS **c27**
C. Belinski and F. LalauKeraly *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-1 (ESA-TT-407) Sep. 1977 p 80-98 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-1, Jan.-Feb. 1977 p 39-47 Original report in FRENCH previously announced as A77-27743 (For availability see N78-11984 02-99)
Avail: NTIS HC A07/MF A01

The flammability of new heat resisting resins developed at ONERA, PQZ (polyquinazoline), and PSP (polystyrylpyridine), was studied by three different methods: the limit oxygen index, self-ignition, and pyrolysis. Results indicate excellent resistance to fire (PQZ resin), with the PSP resin quite equivalent to phenolic resins. Author (ESA)

N78-11989# European Space Agency, Paris (France).
CAST COMPOSITE MIRRORS FOR INFRARED RADIATIONS **c74**
Marie-Paule Lemaitre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-1 (ESA-TT-407) Sep. 1977 p 99-133 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-1, Jan.-Feb. 1977 p 49-61 Original report in FRENCH previously announced as A77-27744 (For availability see N78-11984 02-99)
Avail: NTIS HC A07/MF A01

The design and fabrication are described of mirrors made of multilayer carbon-resin composites for use in the infrared range around 10 microns. An ONERA finite elements computing program is implemented to optimize the multilayer structure of the mirrors so as to minimize the deformations under thermal loading. Casting mountings permitted the fabrication of 120 mm diameter mirrors (plane), spherical with 180 mm radius of curvature, parabolic with 90 mm focal length, and spherical mirrors with a 200 mm diameter and a 300 mm radius of curvature. Quality was studied with a schlieren apparatus adapted to a climatic cell to monitor in situ the evolution of the mirrors with temperature. The size of the image spots is much larger than the expected diffraction limit. Temperature variations do not degrade wavefront quality. Author (ESA)

N78-11990# European Space Agency, Paris (France).
INFLUENCE OF OVERAGING AT 175 C ON THE FATIGUE CRACK GROWTH RATE OF A 7075 ALUMINUM ALLOY **c26**
Guy Ramusat and Georges Vidal *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-1 (ESA-TT-407) Sep. 1977 p 134-140 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-1, Jan.-Feb. 1977 p 63-66 Original report in FRENCH previously announced as A77-27745 (For availability see N78-11984 02-99)
Avail: NTIS HC A07/MF A01

Results are presented of an investigation into the influence of overaging at 175 C (duration of 4 h and 8 h) on the rate of fatigue crack growth of a 7075 aluminum alloy at delivery state T6. ESA

N78-11991# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTHLY BULLETIN NO. 1977-2
Sep. 1977 181 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-2, Mar. - Apr 1977 p 67-132 Original French report available from ONERA, Paris FF 30
(ESA-TT-408) Avail: NTIS HC A09/MF A01

The following topics are discussed: the Contensou switching theory for trajectory optimization, incompressible boundary layer transition, quantitative holographic interferometry in two-dimensional transonic flow, a new thermosetting resin matrix for heat and fire resistant laminates, and acoustic emission from coherent structures in a turbulent jet. Brief reviews are presented on the complexity of the role of compressibility in fluid mechanics, highly cambered turbine blades in a cascade oscillating in transonic flow, and isoparametric finite elements of a multilayer shell. For individual titles, see N78-11992 through N78-11999.

N78-11992# European Space Agency, Paris (France).
ON THE CONTENSOU SWITCHING THEORY **c15**
Nguyen X. Vinh *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-2 (ESA-TT-408) Sep. 1977 p 1-25 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-2, Mar. - Apr. 1977 p 67-74 Original report in FRENCH previously announced as A77-32944 (For availability see N78-11991 02-99)
Avail: NTIS HC A09/MF A01

Switching conditions are expressed systematically and explicitly in terms of the derivatives of the Hamiltonians at the two ends of switching. A new form of the Kelley-Contensou necessary condition for the optimality of a singular arc is presented. As applications, the generalized Fuller problem and the optimal maneuvers of a powered missile in horizontal flight are considered. Author (ESA)

N78-11993# European Space Agency, Paris (France).
EXPERIMENTAL AND THEORETICAL STUDY OF BOUNDARY LAYER TRANSITION
Daniel Arnal and Jean-Claude Juillen *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-2 (ESA-TT-408) Sep. 1977 p 26-63 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-2, Mar. - Apr. 1977 p 75-88 Original report in FRENCH previously announced as A77-28927 (For availability see N78-11991 02-99)
Avail: NTIS HC A09/MF A01

The transition of an incompressible boundary layer, with zero pressure gradient and low free-stream turbulence was investigated. Mean velocity and turbulence profiles are presented. The development of the Tollmien-Schlichting waves is clearly shown until the turbulent spots appear. The intermittency phenomenon was studied by conditional sampling of the hot wire signal; laminar and turbulent properties of the flow during transition are separately determined by this technique. Author (ESA)

N78-11994# European Space Agency, Paris (France).
QUANTITATIVE HOLOGRAPHIC INTERFEROMETRY IN TWO-DIMENSIONAL TRANSONIC FLOW **c02**
Jean Delery, Jean Surget, and Jean-Paul Lacharme *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-2 (ESA-TT-408) Sep. 1977 p 64-95 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977 - 2, Mar.-Apr. 1977 p 89-101 Original report in FRENCH previously announced as A77-32945 (For availability see N78-11991 02-99)
Avail: NTIS HC A09/MF A01

Quantitative interferometry is widely used at ONERA for the detailed analysis of transonic flows, whose great sensitivity to perturbating effects of material probes is well known. The introduction of holographic techniques made it possible to realize an interferometer presenting many advantages as compared to the classical Mach-Zehnder apparatus. An entirely automatic processing procedure was developed. It makes use of a high precision microdensitometer connected to a minicomputer. The program ensures the identification of the fringe center lines and the calculation of their order of interference; it then determines the local value of the density. Author (ESA)

N78-11995# European Space Agency, Paris (France).
THE PSP RESIN, A NEW THERMOSETTING MATRIX FOR HEAT AND FIRE RESISTANT LAMINATES **c42**
Marcel Ropars and Bertrand Bloch *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1077-2 (ESA-TT-408) Sep. 1977 p 96-122 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-2, Mar. - Apr. 1977 p 103-112 Original report in FRENCH previously announced as A77-32946 (For availability see N78-11991 02-99)
Avail: NTIS HC A09/MF A01

The PSP thermosetting resin is described as a matrix for carbon reinforced laminates. These new materials possess high mechanical properties between room temperature and 150 C, resistance to fatigue, moisture and chemical reactants, and outstanding fire resistance. In addition, their good mechanical strength in the temperature range of from 150 to 350 C, with a thermostability of several thousand hours between 225 and 250 C, some one hundred hours at 300 C and about 24 hours at 350 C, seems adequate for them to be considered for the construction of hot parts of aircraft of the next generation.
Author (ESA)

N78-11996# European Space Agency, Paris (France).
ACOUSTIC EMISSION FROM COHERENT STRUCTURES IN A TURBULENT JET **c71**
Claude Dahan *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-2 (ESA-TT-408) Sep. 1977 p 123-157 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-2, Mar. - Apr. 1977 p 113-126 Original report in FRENCH previously announced as A77-32947 (For availability see N78-11991 02-99)
Avail: NTIS HC A09/MF A01

Infrared radiometers were developed to study the turbulent temperature field in a locally subsonic hot jet. The analysis of the coherence properties of the infrared signal shows the existence, within a certain bandwidth, of organized movements over important lengths (large scale structures). A signal analysis procedure was developed, based on the analysis of the spectral relations between infrared signals and pressure signals picked up in the near or far field, making it possible to have access to a quantitative evaluation of the acoustic efficiency of these structures. A description of the coherent movements in terms of unstable waves by a linearized theory of the spatial instability agrees reasonably well with available experimental results.
Author (ESA)

N78-11997# European Space Agency, Paris (France).
COMPLEXITY OF THE ROLE OF COMPRESSIBILITY IN FLUID MECHANICS **c34**
Robert Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-2 (ESA-TT-408) Sep. 1977 p 158-164 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-2, Mar. - Apr. 1977 p 127-128 Original report in FRENCH previously announced as A77-32948 (For availability see N78-11991 02-99)
Avail: NTIS HC A09/MF A01

It is maintained that it is not safe to neglect the effects of compressibility in fluid mechanics. These effects are evident in the local fluid-mechanical equations as well as in the boundary conditions. Accepting the erroneous hypothesis that the Mach number always characterizes compressibility may lead to erroneous numerical results.
Author (ESA)

N78-11998# European Space Agency, Paris (France).
HIGHLY CAMBERED BLADES, MOUNTED IN CASCADES AND OSCILLATING IN A FLUID IN TRANSONIC FLOW **c02**
Robert Legendre *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-2 (ESA-TT-408) Sep. 1977 p 165-172 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-2, Mar.-Apr. 1977 p 129-130 Original report in FRENCH previously announced as A77-32949 (For availability see N78-11991 02-99)
Avail: NTIS HC A09/MF A01

A method is presented for calculating unsteady aerodynamic forces acting on highly cambered turbine blades mounted in a two-dimensional cascade and oscillating in the compressible fluid which crosses the cascade at transonic flow. The method is applied in particular to the calculation of the unsteady irrotational perturbations on the blades and the shock waves arising.
Author (ESA)

N78-11999# European Space Agency, Paris (France).
ISOPARAMETRIC FINITE ELEMENTS OF MULTILAYER SHELL FOR THE CALCULATION OF AEROSPACE STRUCTURES IN COMPOSITE MATERIALS **c39**
Raoul Girard *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1977-2 (ESA-TT-408) Sep. 1977 p 173-177 ref Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1977-2, Mar - Apr. 1977 p 131-132 Original report in FRENCH previously announced as A77-32950 (For availability see N78-11991 02-02)
Avail: NTIS HC A09/MF A01

Isoparametric finite elements are formulated for the calculation of composite materials with high-modulus fibers for use in aerospace multilayer shell structures. The elements are given a multilayer representation, each of the layers assumed to be homogeneous and with linear elastic, but anisotropic properties.
Author (ESA)

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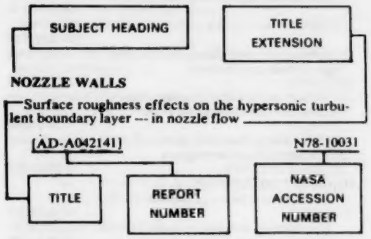

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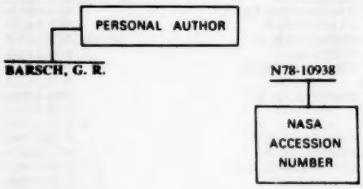

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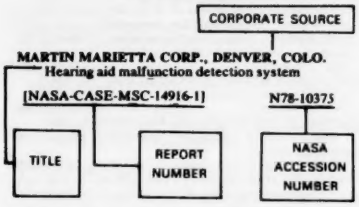

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Life science payloads planning study
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MCDONNELL-DOUGLAS RESEARCH LABS., ST. LOUIS, MO.
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Models and techniques for evaluating the effectiveness of aircraft computing systems
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MONSANTO RESEARCH CORP., DAYTON, OHIO.
Source assessment: Overview matrix for national criteria pollutant emissions
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N

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NATIONAL ACADEMY OF SCIENCES - NATIONAL RESEARCH COUNCIL, WASHINGTON, D. C.
Fire toxicology: Methods for evaluation of toxicity of pyrolysis and combustion products
[AD-A043899] N78-11224

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, D. C.
Aeronautical Engineering: A special bibliography with indexes, supplement 87
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Aerodynamic investigation of an air-cooled axial-flow turbine. Part 2: Rotor blade tip-clearance effects on overall turbine performance and internal gas flow conditions: Experimental results and prediction methods
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Effects of Fe2O3 addition on the nitridation of silicon powder
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Physical-chemical examination of the N2O3-SO3-H2O system
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Inorganic chemistry: Direct syntheses from pure liquid SO3 and from trivalent and pentavalent nitrogen derivatives
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Aerospace Medicine and Biology: A continuing bibliography with indexes, supplement 172
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Suprachiasmatic nuclei and Circadian rhythms. The role of suprachiasmatic nuclei on rhythmic activity of neurons in the lateral hypothalamic area, ventromedian nuclei and pineal gland
[NASA-TM-75155] N78-11690
Studies of perception of information on the spatial position of an aircraft
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Analytical representation of elastic scattering cross sections of low energy electrons by atmospheric gases
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[NASA-TM-78623] N78-11861
NASA Patent Abstracts Bibliography: A continuing bibliography. Section 2: Indexes supplement 11
[NASA-SP-7039[11]] N78-11865
The lunar nomenclature: The reverse side of the moon [1961-1973]
[NASA-TM-75035] N78-11960
Early stages in the evolution of the atmosphere and climate on the Earth-group planets
[NASA-TM-75054] N78-11961
Soviet-French working group interpretation of the scientific information during the search for celestial sources of gamma pulses, abstract of reports, 24-30 March 1977
[NASA-TM-75050] N78-11967
A gamma-ray testing technique for spacecraft
[NASA-TM-75053] N78-11968

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. AMES RESEARCH CENTER, MOFFETT FIELD, CALIF.

Improvements in microelectrophoretic apparatus and process
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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEX.

Reciprocating engines
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[NASA-TM-58205] N78-11704

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. JOHN F. KENNEDY SPACE CENTER, COCOA BEACH, FLA.

Thunderstorm Research International Program [TRIP 77] report to management
[NASA-TM-74740] N78-11638

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LANGLEY RESEARCH CENTER, LANGLEY STATION, VA.

Laser velocimeter systems analysis applied to a flow survey above a stalled wing
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Liquid hydrogen flash vaporizer
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An electrically scanned pressure sensor module with in situ calibration capability
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Experimental measurements of the ground cloud effluents and cloud growth for the May 20, 1975, Titan 3C launch at Air Force Eastern Test Range, Florida
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Some physical and thermodynamic properties of rocket exhaust clouds measured with infrared scanners
[NASA-TP-1041] N78-11520
An investigation of ride quality rating scales
[NASA-TP-1064] N78-11696
A finite element simulation of sound attenuation in a finite duct with a periphally variable liner
[NASA-TM-74080] N78-11798

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND, OHIO.

Experimental performance of a 13.65-centimeter-tip-diameter tandem-bladed sweptback centrifugal compressor designed for a pressure ratio of 6
[NASA-TP-1091] N78-11002
Effect of coolant flow ejection on aerodynamic performance of low-aspect-ratio vanes. 2: Performance with coolant flow ejection at temperature ratios up to 2
[NASA-TP-1057] N78-11008
Aircraft engine emissions
[NASA-CP-2021] N78-11063
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Secondary-electron-emission properties of conducting surfaces with application to multistage depressed collectors for microwave amplifiers
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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALA.

Wind shear modeling for aircraft hazard definition
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Ground winds and winds aloft for Edwards, AFB, California
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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. PASADENA OFFICE, CALIF.

Azimuth correlator for real-time synthetic aperture radar image processing
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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. WALLOPS STATION, WALLOPS ISLAND, VA.
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NATIONAL AEROSPACE LAB., AMSTERDAM [NETHERLANDS].
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The application of fracture mechanics to creep crack growth
[NLR-MP-76025-U] N78-11428

NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER, ATLANTIC CITY, N. J.
Simulation model for air traffic control communications
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Full-scale aircraft crash tests of modified jet fuel
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NATIONAL BUREAU OF STANDARDS, BOULDER, COLO.
Cryogenic foam insulation: Abstracted publications
[NASA-RP-1002] N78-11200

NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.
A bibliography of sources of experimental data leading to activity or osmotic coefficients for polyvalent electrolytes in aqueous solution
[PB-270367/6] N78-11225
The international system of units [SI]
[NBS-SP-330] N78-11258
Digital data transmission tests on voice channels
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NATIONAL CENTER FOR SCIENTIFIC AND TECHNICAL DOCUMENTATION, BRUSSELS [BELGIUM].
Books on air pollution noise and solid wastes
N78-11533

NATIONAL CENTRE OF TRIBOLOGY, RISLEY [ENGLAND].
Thermal vacuum life test of an HSD solar array drive [HSD no. 2]. First two years of operation
[ESA-ESTL-23] N78-11514

NATIONAL COMMISSION ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS, WASHINGTON, D. C.
Transcript of CONTU meeting, 15th
[PB-271326/1] N78-11871

NATIONAL GAS TURBINE ESTABLISHMENT, PYESTOCK [ENGLAND].
The use of co-flowing airstreams for the simulation of flight effects on jet noise
[NGTE-R-345] N78-11802

NATIONAL GEOGRAPHIC SOCIETY, WASHINGTON, D. C.
National geodetic satellite program, part 2
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NATIONAL GEOPHYSICAL AND SOLAR-TERRESTRIAL DATA CENTER, BOULDER, COLO.
Solar-geophysical data number 393. Part 2: Comprehensive reports. Data for November 1976-October 1976 and Miscellanea
[PB-270310/6] N78-11965
Solar-geophysical data number 393. Part 1: Prompt reports. Data for April 1977 - March 1977
[PB-270309/8] N78-11969

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, WASHINGTON, D. C.
Seat belt performance in 30 M.P.H. barrier impacts
[PB-269962/7] N78-11721

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, BOULDER, COLO.
Wind shear characterization
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Weather Modification Program Office collected reprints, 1975-1976
[PB-270307/2] N78-11646
A study of the capability for rapid warnings of solar flare radiation hazards to aircraft. Part 1: Forecasts and warnings of solar flare radiation hazards. Part 2: An FAA polar flight solar cosmic radiation forecast/warning communication system study
[PB-270284/3] N78-11964

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, SEATTLE, WASH.
Coastal upwelling ecosystems analysis. Data report 36: STD measurements off Spanish Sahara, March/April 1974
[PB-268963/6] N78-11661

NATIONAL PHYSICAL LAB., TEDDINGTON [ENGLAND].
Thermodynamic properties of single substances and defined mixtures: A summary of the measurement and data activities of the Division of Chemical Standards
[NPL-CHEM-71] N78-11228
Thermal stress and thermal shock in ceramics. A survey of industrial problems and a review of test methods and thermal stress theory
[NPL-CHEM-66] N78-11248
Industrial energy thrift scheme
[NPL-CHEM-68-PR-1] N78-11510

NATIONAL SCIENTIFIC AND TECHNICAL INFORMATION BUREAU, PARIS [FRANCE].
The National Scientific and Technical Information Bureau
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NATIONAL SWEDISH ROAD AND TRAFFIC RESEARCH INST., LINKOEPING.
The effect of day-time vehicle lighting on road accidents in Finland
[VTI-102] N78-11406

NAVAL AIR DEVELOPMENT CENTER, WARMINSTER, PA.
Acceleration effects on the ability to activate emergency devices in F-4 aircraft
[AD-A042281] N78-11715

NAVAL AIR TEST FACILITY, LAKEHURST, N.J.
Deadload calibration program of CVN 68 catapult configuration
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NAVAL CIVIL ENGINEERING LAB., PORT HUENEME, CALIF.
Porous friction surface runway at USNAS Dallas, Texas
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Fungal-resistant organotin paints
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A finite element head injury model. Volume 2: Computer program documentation
[AD-A043582] N78-11693
A finite element head injury model. Volume 1: Theory, development, and results
[AD-A043605] N78-11694

NAVAL INTELLIGENCE SUPPORT CENTER, WASHINGTON, D. C.
A study of the effect of welding stresses on the supporting power of titanium alloy welded members under static and cyclic loading
[AD-A043712] N78-11424

NAVAL OCEANOGRAPHIC OFFICE, WASHINGTON, D. C.
Aerial ice reconnaissance and satellite ice information microfilm file 1976, supplement 1
[AD-A043046] N78-11491

NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIF.
Design, construction and testing of a sub-scale turbojet test cell
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NAVAL RESEARCH LAB., WASHINGTON, D. C.
Calculation of gas temperatures in N2 pressurization experiments
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NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, BETHESDA, MD.
An assessment of circulation control airfoil development
[AD-A043826] N78-11012
Computer center reference manual
[AD-A043559] N78-11738

NAVAL SURFACE WEAPONS CENTER, WHITE OAK, MD.
High power spark gap switch program
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[AD-A042676] N78-11303

NAVAL TRAINING EQUIPMENT CENTER, ORLANDO, FLA.
Theoretical analysis of the proposed panoramic moving target screen simulator
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NAVAL WEAPONS SUPPORT CENTER, CRANE, IND.
Sensitivity of the Shoe-Box in P001 analysis
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NAVY EXPERIMENTAL DIVING UNIT, PANAMA CITY, FLA.
Analysis of multivariate data: A computer program
[AD-A043180] N78-11737

NETHERLANDS COMMITTEE FOR GEOPHYSICS AND SPACE RESEARCH, AMSTERDAM.
Space research in the Netherlands, 1976
N78-11953

NETHERLANDS INTERDEPARTMENTAL WORKING GROUP ON THE APPLICATION OF REMOTE SENSING, DELFT.
Evaluation of an infrared line scanner for the study of coastal water circulation
[NIWARS-PUBL.-41] N78-11496

NEW MEXICO STATE UNIV., UNIVERSITY PARK.
Color research for visual displays
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NEW MEXICO UNIV., ALBUQUERQUE.
The use of prior observations in constructing prediction intervals for the normal distribution
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The effects of radiation on the interface state density of MOS transistors
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NEW YORK UNIV., N. Y.
Design of transonic cascades by conformal transformation of the complex characteristics
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Forbidden resonant Raman scattering and spectroscopy in the yellow exciton series of cuprous oxide
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NORTH CAROLINA UNIV., CHAPEL HILL.
Optimization strategies for the analysis of chemical data
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Divide and conquer algorithms for closest point problems in multidimensional space
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A theoretical study of superionic conductors: Beta alumina and rubidium silver iodine
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NORTH CAROLINA UNIV., CHARLOTTE.
Shock and wear models and the related replacement policies
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NORWEGIAN CENTER FOR INFORMATICS, OSLO.
The Norwegian-Scandinavian scientific and technical information scene
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Information 1990: A Norwegian scenario
N78-11876

NORWEGIAN DEFENCE RESEARCH ESTABLISHMENT, KJELLER.
The small nations' needs for scientific and technical information: The case of Norway
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O

OAK RIDGE NATIONAL LAB., TENN.
SOLGASMIX-PV: A computer program to calculate equilibrium relationships in complex chemical systems
[ORNL/TM-5775] N78-11227
Transportation energy conservation data book, supplement-3
[ORNL-5248] N78-11508

OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES, PARIS [FRANCE].
Influence of initial distortions on secondary flows in a fixed annular cascade
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Effects of secondary flows in straight cascades
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Cascade test methods in wind tunnnel at ONERA
N78-11332

OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES, TOULOUSE [FRANCE].
Qualification of thermal control coatings for ultraviolet and particle radiation in space
[ONERA-DERTS-29/4025/TS] N78-11352
Progress in the calculation of two and three dimensional turbulent boundary layers
[AAAF-NT-77-02] N78-11355

OFFICE OF NAVAL RESEARCH, LONDON [ENGLAND].
European developments in the Na/S high temperature battery for automobile propulsion and energy storage
[AD-A042541] N78-11501

OHIO STATE UNIV., COLUMBUS.
Application of Fourier transform spectroscopy to air pollution problems, computer generated long-path air spectra
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OHIO UNIV., ATHENS.
Neutron inelastic scattering from closed-shell nuclei N78-11809
Superconductivity and specific heat measurements in V-Nb-Ta ternary alloys N78-11847
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MERADCOM/OSU hydraulic system reliability program. Section 1: Hydraulic noise attenuation [AD-A043633] N78-11348
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Correlation and analysis of elevon seal test results [NASA-CR-155224] N78-11051
OWENS-ILLINOIS, INC., TOLEDO, OHIO.
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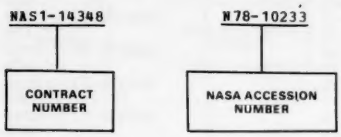

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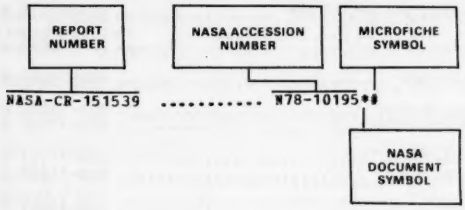

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